PUBLISHED DECEMBER 26, 1919, WITH CURRENT NEWS

Electrical World

McGraw-Hill Company, Inc. New York, December 20, 1919 Fifteen Cents a Copy

Engineering Library
GENERAL LIBRARY
JAN 2 1920
UNIV. OF MICH.

For Sudden Peak Loads -and the straight long pull

Worthington Snow Oil Engines can be started on a moment's notice. Less than one minute is required to bring them up to speed, ready to take the load.

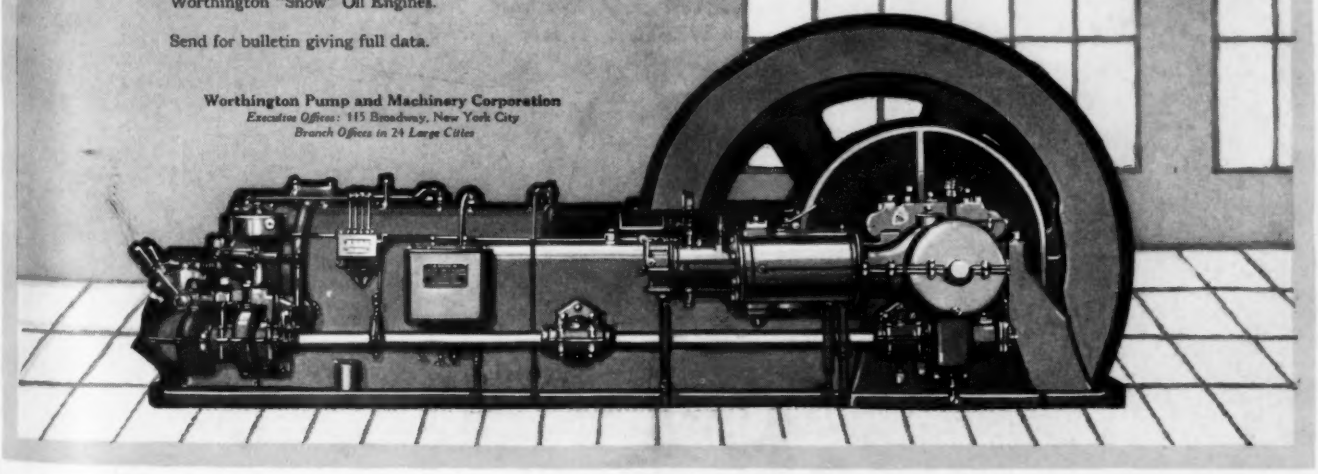
They are equally economical on long steady loads, and show slight variation in fuel economy through considerable power ranges. The Standard Worthington Fuel Consumption Guarantee, based on 18,500 B.T.U. oil is:

Full Load	.48	lbs. per B.H.P. hour
¾ "	.50	" " " "
½ "	.57	" " " "

No other type of motive power offers so much as Worthington "Snow" Oil Engines.

Send for bulletin giving full data.

Worthington Pump and Machinery Corporation
Executive Offices: 115 Broadway, New York City
Branch Offices in 24 Large Cities

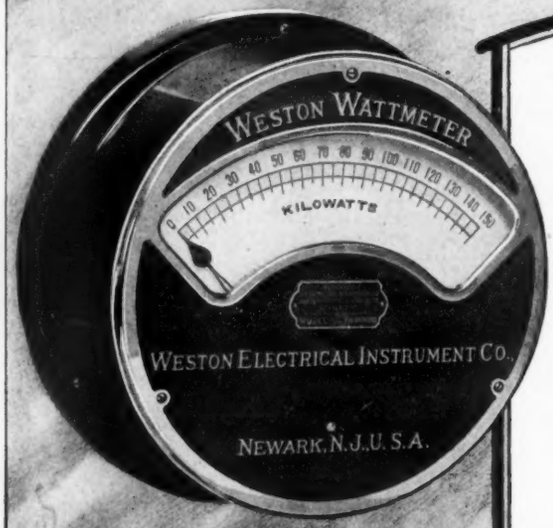


PUMPS – COMPRESSORS – CONDENSERS – OIL & GAS ENGINES – METERS – MINING – ROCK CRUSHING & CEMENT MACHINERY

WORTHINGTON

Deane Works, *Holyoke, Mass.* Blake & Knowles Works *East Cambridge, Mass.* Worthington Works *Harrison, N. J.* Holston Works, *Kingsport, Tenn.* Laidlaw Works, *Cincinnati, Ohio* Gas Engine Works, *Cudahy, Wis.* Power & Mining Works *Cudahy, Wis.* Snow-Holly Works *Buffalo, N. Y.*

On Guard!



Where Extreme Reliability Is Essential

The development of the electrification of railroads has been made possible by the perfection of the art of electrical measurement. This Company originated the art as it is known and practiced today, and practically every improvement has emanated from this source. That is why

Weston

Alternating Current Switchboard Instruments

are on guard over so many electric railway power plants, insuring the most efficient control and usage of the electrical machinery and the most accurate supervision of power distribution.

Model 167 Wattmeter, one of the remarkable group of Switchboard Instruments supplied by this Company, is herewith illustrated.

Write us for catalogs or bulletins, specifying the field that interests you.

WESTON ELECTRICAL INSTRUMENT CO.
13 WESTON AVE. :: NEWARK, N. J.

Published December 26 With Current News

Electrical World.

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 74 New York, Saturday, December 20, 1919 *Number* 21

An Experiment Vindicated

THE recent reorganization of the utility-regulating bodies of Massachusetts calls attention to the fact that it is thirty-five years since that state organized, under another name, the first public service commission. Now every state in the Union save Delaware has a body of this description, as have also the District of Columbia, Hawaii, the Philippines, and nearly all the Canadian provinces. Though these various bodies differ in powers and scope of jurisdiction, they are all organized in accordance with the idea that the acts of corporations chartered to serve the people should be approved by an impartial tribunal. This principle has grown in a generation to universal acceptance. The corporations themselves would to-day protest against the abolition of the commissions. They are as essential as the courts. Like the courts they should harbor neither fossils nor firebrands. They have a chance to make public service regulation so popular that public ownership will lose its glamour.

Progress is vital, but all motion is not progress. Stagnation is fatal, but all change is not improvement. In times of unrest and contention and vociferous unreason may not the citizen of greatest patriotism be he who stands pat and waits till the clouds roll by?

The Lesson of Fuel Reserves

CENTRAL STATIONS do not need to learn the lesson that fuel reserves are vitally necessary. They had that truth, acquired by instinct, as it were, when they emerged from swaddling clothes. Their experiences in the recent strike of bituminous coal miners have carried them a step further in higher education on this subject. They cannot run near the danger line of exhaustion of reserve supply of fuel. If the steam stations cling to coal as their primary fuel, they still have an alternative fuel possibility in oil. Several instances are reported where contracts have been closed or are under consideration for the purchase of fuel oil for consumption by large central-station companies. One of the risks where a central-station company commits itself to the use of oil alone is that the price of this fuel will advance to a prohibitive point. It should be kept in mind that many gas companies have been burdened heavily by the increases which they have had to meet in oil cost. Nevertheless, oil offers an attractive possibility to the central electric stations and its use, even at high cost, is preferable to a curtailment of operations. As public utilities the obligation rests upon the central stations to render uninterrupted service and the industry is not satisfied unless it can show that it is making superhuman efforts to meet that obligation. When its efforts, in spite of all precautions, are brought to naught by unwarranted interference from outside, it is justified in disclosing where the responsibility lies. When this responsibility lies clearly at the door of the strikers or of the Railroad Administration, the public is entitled to have all the facts. Mr. Dow found it necessary to tell the Detroit public how the policy of the Railroad Administration had hampered his endeavors to build up a reserve, and his indictment of it was just.

Combining resources to carry forward research may well be undertaken by small industrial and utility companies hitherto unacquainted with the benefits of systematic expert study of baffling problems. The field of non-competitive, overlapping interests is so great that even small appropriations may be pooled advantageously in supporting such work.

Inductive Interference

THE publication by the California Railroad Commission of the technical work of the California Joint Committee on Inductive Interference draws attention to a subject that by reason of its growing importance demands study. The early development of high-voltage transmission lines in California brought the problem of interference to the fore several years ago. Out of the efforts to meet it came the appointment by the California Railroad Commission late in 1912 of a joint committee of engineers, representing power and communication interests, to compile information on the subject. During the next five years this committee conducted extensive field investigations and studies, which resulted in recommendations for rules for the guidance of power and communication companies with parallel lines. The volume now published includes, besides the committee's previously published reports to the commission and the resulting general order of the commission, about thirty of its technical reports, covering tests made on lines under operating conditions, tests on lines under special experimental conditions, very extensive theoretical studies of the severity of induction for given separations, configurations, etc., of the paralleling lines, data on the relative importance of different kinds of induction, methods of transposing of lines, descriptions of methods and apparatus for the required measurements and calculations, etc. No claim is made that the subject has been exhausted. However, the publication constitutes by far the most complete collection of such material that has appeared, and it should prove of great value.

The Increasing Use of Oil Fuel

THERE is just now apparent a strong tendency toward the utilization of fuel oil for central-station work. As our readers know, a good many plants are now using fuel oil either wholly or in part, particularly in regions where it is easily obtainable. However, its larger use, not merely as a near-by fuel cheaply obtainable, but as an actual substitute for coal in general service, has made progress less rapidly. With a number of large stations now experimenting on the subject and some considerable plants already going, the whole matter assumes a new importance. In certain respects fuel oil possesses on land as at sea very obvious advantages. It has a high thermal value per unit of weight, is easily stowed and fired, eliminates the necessity of ash disposition and permits ready forcing of boilers. If it were obtainable in sufficient quantity at economical figures, it would push coal hard, particularly as it has the advantage of being transportable by pipe lines as well as by boats or trains. The partial elimination of transportation troubles is just now an important matter.

The outstanding question, and one far from easy to answer, is the ultimate economy of oil burning considered over a reasonable term of years. This at once raises the question of supply, bearing in mind the greatly increasing use of oil fuel on the ocean and the fact that it is being now employed for general heating purposes, as of buildings, as well as for the generation of power. Last year the coal mines of the United States put out a little more than 600,000,000 tons of coal of all sorts, all of it available for burning for one purpose or another. Most of this total quantity was consumed in the United States, the exportation during that period not being, for obvious reasons, any material part of the whole supply. As against this prodigious fuel output the oil production in the same year ran to nearly 14,000,000,000 gallons (53,000,000,000 liters) of the crude product, equivalent roughly to 55,000,000 tons, or in thermal value somewhat less than the equivalent of 100,000,000 tons of coal, say not far from 15 per cent of the total thermal potentiality of the solid fuel.

There seems to be little agreement of opinion as to the probable future output. On the one hand, oil wells in new regions are being opened up; on the other, some good judges maintain that any considerable expansion of the use of crude oil will require drawing to a considerable extent on fields outside our own country. Be this as it may, the oil fields do not seem likely to furnish any more reliably expanding output than do the coal fields, so that in respect to the future the two fuels may be regarded as practically upon all fours.

Further, the necessity of refining a considerable and increasing amount of oil for the production of gasoline and kerosene makes necessary inroads on the amount usable for fuel. The call for gasoline alone last year was more than 3,500,000,000 gallons (13,000,000,000 liters), and unless a substitute fuel for internal-combustion engines is introduced on a large scale this quantity will rapidly increase. It is apparent therefore that even at present prices we cannot depend on oil fuel for any considerable proportion of the thermal output required for the needs and industries of the country. And unstable as is the price of coal that of oil is subject to still greater fluctuations.

A fuel-using plant where oil can be obtained cheaply owing to situation, or which is enabled to make long-term contracts for a regular supply, will probably be able to effect sufficient economies to justify the change, but the situation as to future supplies makes the outlook for oil burning on a very large scale somewhat dubious. It is one of those things which can very easily work to the wrong side of the balance sheet by a notable increase in demand, so that, attractive as the plan seems for very many reasons, it should be undertaken with a good deal of caution.

Electrical jobbers and dealers often complain that the manufacturers do not allow them a sufficient margin of profit. Perhaps the contention is sometimes true, but attractive manufacturing profits mean an increasing number of factories, greater production and larger sales. This is the condition in the electrical industry and is one of the reasons for its growth and stability. It is operating on a sound basis at a time when many lines of business are so topheavy that dealers are making more profit than the producers.

The New Dynamical System of Units in France

IT WAS France that gave to the world, at the end of the eighteenth century, the wonderfully simple metric system of weights and measures, in which the meter and the gram, together with their decimal correlatives, took the place of so many crude and complicated systems of local and national measures. The international metric system has since become the world standard of scientific and industrial measures.

The dynamical system of units, based upon the metric system, as originally promulgated in France, was the meter-kilogram-second system. It shared the advantages of the metric system in regard to simplicity and ease in computation, but it had the disadvantage of containing an inherent inconsistency. The kilogram was not the mass of the unit volume at unit density. The unit volume was the cubic meter, and the cubic meter of water had a mass of a metric ton, or 1000 kilograms. This inconsistency led, in fact, to the adoption of the centimeter-gram-second or C. G. S. system for the fundamental electrical units.

France, as noted elsewhere in this issue, has recently ought to eliminate this inconsistency. Retaining the international metric system on the one hand and the international electric units on the other, she has promulgated a new dynamical system; *i. e.*, the meter-ton-second system, or M. T. S. system, for mechanical engineering work. In this new system the units of length, area and volume are respectively the meter, square meter and cubic meter. The unit of mass is the metric ton or the cubic meter of water under standard conditions. The unit of time is our old familiar mean solar second. In the resulting M. T. S. system the unit of force is that which, acting on the ton for one second, generates in it the unit velocity of one meter per second. This force is called the sthène and is 10^8 dynes, or a dyne-eight. It is also roughly equal to the weight of 100 kilograms.

The unit of pressure becomes the sthène per square meter, which is called the pièze. It is roughly one hundred times less than normal atmospheric pressure.

In the M. T. S. system the kilojoule is the systematic unit of energy or work and the kilowatt the systematic unit of activity or power. This forms the connecting link with the international electric system of the volt, ampere, ohm, etc. It should be observed, however, that

these international electric units are not members of the M. T. S. system. They are recognized as being members of an A. E. S. dynamical system (quadrant-eleventh gram-second system), so that it is not surprising that they do not dovetail into the M. T. S. system on the one hand, or into the C. G. S. system on the other. They are metric units in the general sense, but they form a group by themselves.

There can be no doubt that the M. T. S. system is a more logical system, for mechanical engineering purposes, than the other systems which it is designed to replace. Three new names have to be learned to go with it, viz., the sthène, the pièze and the thermie; but this extra mental effort is well worth while. Incidentally, insistence is laid on the quadrant and grad decimal angles, instead of the degree, minute and second. The degree centigrade in temperature is also defined with satisfactory precision. We recommend the M. T. S. system to the favorable consideration of all engineers.

Morally the farmer is entitled to service from a central station's lines if he is willing to pay a price for the service which will yield as much profit as a city customer yields. Legally he may not be entitled to service at all under the public utility laws of some states. It will be interesting to see whether moral right or legal right prevails.

Steel-Mill Motors

SERIOUS consideration must be given to the use of alternating-current motors for heavy rolling-mill work. Most steel mills utilize, at least for their severer tasks, direct-current machines operated with very precise provisions for speed control. It is well known that it is possible also to get excellent speed control from alternating-current motors, but their use in the particular function here considered has not been worked out as completely as in the case of direct-current motors. Considering a group of typical operations in a steel mill, it has been found by one engineer, as might be anticipated, that the actual motor installation is more costly for alternating-current apparatus than for direct-current to the extent of 20 per cent or more. As against this stands the difference in cost of supply to the motors, including on the one hand the necessary alternating-current lines and transformers, on the other the addition of the converting apparatus for direct current, which may under some circumstances bring the total direct-current costs to a considerably higher figure than those shown by the rival method. In mills now operating with conversion to direct current addition of capacity or the erection of co-operating mills may be made more cheaply by additions to the existing plant than by starting in with an alternating-current drive.

In entirely new installations some engineers would favor a straight alternating-current operation. From an engineering standpoint, the question turns chiefly on the adaptation of alternating-current motors to the most strenuous and difficult part of rolling-mill operation. That the problem can be worked out successfully there is little reason to doubt, and in the long run it would probably pay to devote considerable attention to its solution. There are, of course, now cases in which direct-current operation is highly desirable, but these are on the whole becoming fewer and fewer, and as time goes on and the great alternating-current distributing systems become even more than now the chief sources of power, there will be a stronger and stronger tendency to drift toward an exclusive use of the more recent type of apparatus. If a large central station could now be erected without having to co-operate with existing direct-current service and without scrapping a very large amount of direct-current apparatus, it is doubtful whether any of the latter would be contained in it as a matter of choice, unless possibly enough to charge a storage battery for the operation of some switchboard auxiliaries.

Chemical analyses and physical tests of supplies help to determine the limitations of material of varied quality and when properly directed and interpreted point the way toward utilizing products which might otherwise be regarded as too inferior for use by a first-class plant.

Industrial Research in a Technical Industry

WE PRINTED a week or two ago an interesting article by M. E. Leeds of Philadelphia on the relations of research to a manufacturing industry and on a proper method of keeping account of these relations. It is evident that in order to come to a clear understanding of the matter it is necessary to define carefully the meaning of the term research. Any time or money expended upon the development of new business, or on activities outside of regular manufacturing routine, may properly be regarded and recorded as research.

From this point of view, there are very few manufacturing firms which have no research costs. In order to avoid all research expense, it is necessary that a firm shall merely accept orders for reduplicating products, exactly as they have been dealt with in the past. No new developments can be undertaken and no modifications of existing developments. But there probably is no surer means for destroying an industry than to restrict it to a beaten track. Every progressive business must set itself the task of attempting new work, or at least of effecting improvements in old work. All such efforts at changes or improvements really involve research, if they are carried out with the right attitude of mind. In this sense nearly all the manufacturing firms, down to the smallest, if they have any vitality, are guilty of research, even though their methods may have been imperfect and their recognition of the fact nil. One is reminded of Moliere's Monsieur Jourdain, who discovered that he had been talking in prose for forty years, without knowing it.

The importance of the viewpoint and procedure advocated in the Leeds article is that if a firm properly and systematically defines its research and research costs, as well as its proceeds resulting from research, it may build up gradually a valuable research department that may come to pay very handsomely. We think that Mr. Leeds is quite right, and, moreover, that if this business aspect of research is properly apprehended by the managers of manufacturing plants, they will not only proceed to build up remunerative research, but they will also be guided away from useless or wasteful research. In industry and business it is necessary that research should pay. A small business has to be solicitous for prompt results. A large business may be able to wait long for a return from its research work. The main thing is that it should be gradually built up with a proper sense of proportion.

Operating Oil-Fired Boilers Efficiently

Some Conditions That Must Be Avoided if Highest Economy Is to Be Attained with Recommended Operating Practices—Sixteen Rules Which Should Bring Efficiency Close to the Test Results

BY ROBERT SIBLEY AND CHARLES H. DELANY

SINCE the advent of steam turbines the relative importance of the fireroom crew as a factor in economical operation has increased considerably compared with the engine-room crew. This is because the steam turbine, after it has once been properly set up, operates continuously at a fixed steam consumption for a given load and nothing can be done to improve its economy other than to keep the turbine, condenser and auxiliaries clean and in good operative condition. In the boiler room, on the other hand, continual watchfulness is necessary to keep the boilers operating at good efficiency, and the slightest laxity in attention to the various details results in a large waste of fuel. To assist the operators of oil-fired boilers in obtaining the best economy possible, the writers have prepared the following set of rules, which if carefully followed will bring the daily operating efficiency of the plant very close to test results:

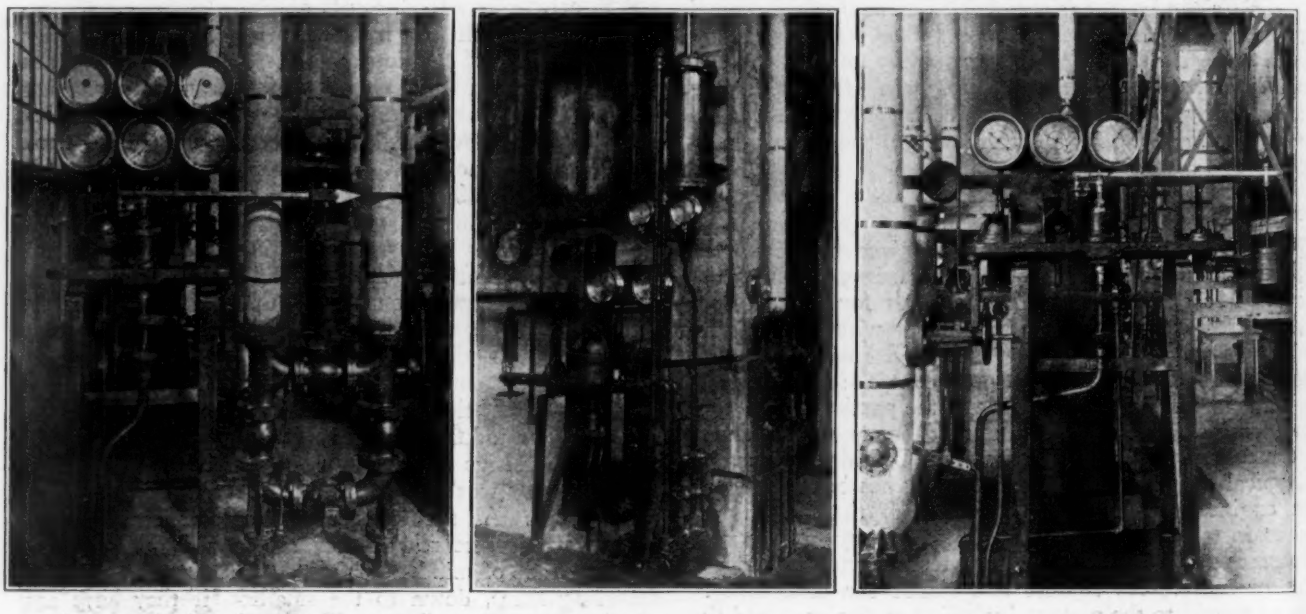


FIG. 1—OIL-BURNING AUXILIARY APPARATUS AT ARIZONA PLANT

A—Oil-to-burner regulator controlling steam and oil pressure. B—Damper controller actuated by hydraulic cylinder. C—Steam-to-burner regulator which controls system used in atomizatior

Air Supply and Regulation

Regulate Air to Suit Load.—The regulation of the air supply is one of the most important things in the operation of oil-fired boilers. If there is not enough air, a great waste of fuel may occur as part of the atomized oil will simply pass up the chimney unburned. On the other hand, it is possible to waste just as much fuel by allowing too much air to enter the furnace as all of the extra air is heated up and passes out at the temperature of the chimney gases, carrying away with it an enormous amount of heat. To determine accurately the amount of air required for the best conditions it is necessary to analyze the flue gases.

Many plants, however, are not provided with the apparatus necessary for this, and in such cases the air may be regulated with a fair degree of accuracy by an observation of the smoke discharged from the stack. For perfect combustion there should be no smoke, and if any smoke appears it means incomplete combustion and not enough air. If there is no smoke, however, it does not follow that the conditions are right, as no smoke may mean either just the right amount of air or a large excess of air. To properly regulate the air, therefore, if the boiler is operating with no smoke the damper should be gradually closed until a light gray smoke just begins to appear; if then the damper is opened very slightly, this smoke will be barely perceptible and the conditions for the most economical operation will be obtained.

Prevent Air Leakage Through Setting.—Air leaks may be detected by holding a candle flame at the cracks in the boiler setting. If the flame is drawn in, it shows that there is an air leak which should be stopped up as far as possible.

A good coat of fire-resisting paint over a brick setting is a good investment, for the bricks themselves are quite porous as can be demonstrated by dropping one in water and noting the air bubbles driven from it.

There are two ways by which the air can be regulated, namely, by the damper at the outlet of the boiler or by the ash-pit doors. If the air is regulated by the ash-pit

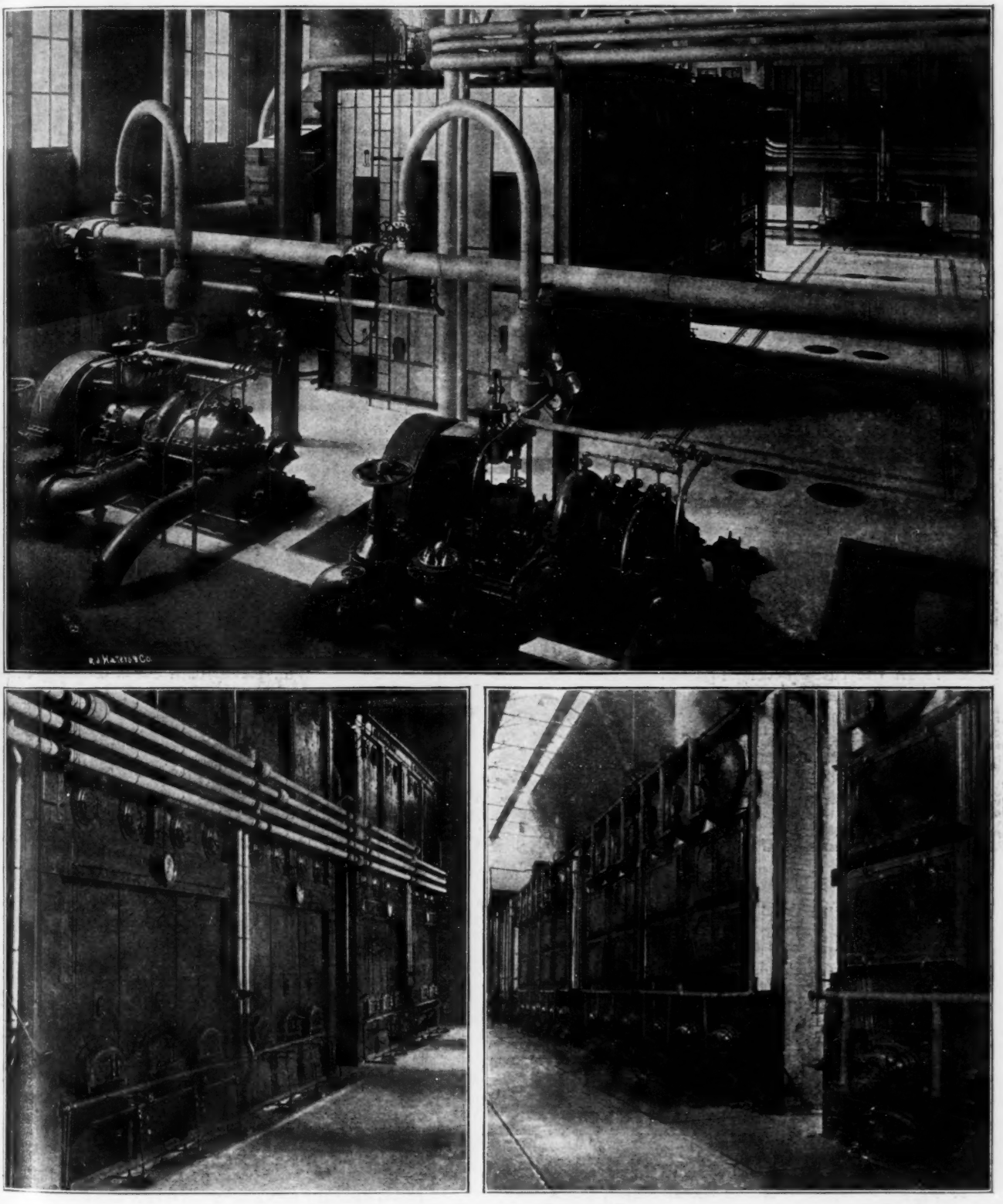


FIG. 2—SOME OIL-BURNING INSTALLATIONS IN THE WEST

A—Steel-cased oil-fired boilers in one-man station applicable to small plants only. B—Some oil-fired boilers in Arizona Power Company's plant where world-record economy was established (333.3 kw.-hr. per barrel of oil delivered). C—A few of the oil-fired boilers at Station A of the Pacific Gas & Electric Company. Only two men are required to operate fifteen boilers here.

doors, the damper being left wide open, there will be a strong draft within the setting, tending to cause air to leak in through all the cracks in the brickwork. The strong draft also tends to pull the gases through the setting by the shortest paths, so that some of the heating surface is not swept by the gases.

If, on the other hand, the ash-pit doors are left wide

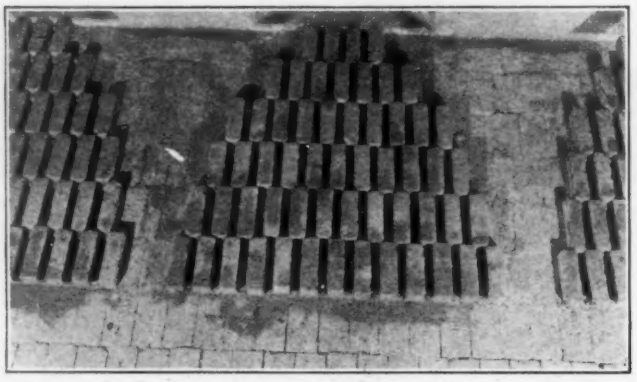


FIG. 3—BRICK CHECKER-WORK FLOOR IN BOILER FURNACE

open and the air is regulated by partly closing the damper, the draft inside the boiler setting is very slight so that the air leakage is reduced to a minimum. There is little force tending to change the direction of the flow of the gases so that they travel of their own momentum to the furthermost corners and fill out the setting completely, thus coming in contact with all the heating surface of the boiler. It is, therefore, much better to regulate the air by means of the damper than by means of the ash-pit doors. In the case of very light loads, however, it is best to use both the damper and the ash-pit doors because if the damper alone is used there may be a positive pressure produced in the upper part of the setting, causing gas and smoke to leak out into the fire room.

Analyze Flue Gases Frequently.—The exact position of the damper to suit different loads can only be determined by flue-gas analysis. The CO_2 should be kept as high as possible without producing CO. If it is found impossible to secure 13½ or 14 per cent of CO_2 without a trace of CO, then there is something wrong with the furnace or the burners and an investigation should be made. The proper method of sampling exit gases should be used as it is quite possible through improper sampling to obtain very poor CO_2 readings even though the furnace may be operating quite effectively. If correctly measured, the greater the CO_2, up to a certain limit, the greater the efficiency.

Selection and Care of Burners

Burner Must Be Suited to Furnace.—The function of the oil burner is to atomize the oil, and the most efficient burner is the burner that will atomize the oil with the least quantity of steam. Burners are of three general types—steam jets, mechanical-pressure jets and air jets. The air jet is largely used in metallurgical work while the mechanical jet, which delivers a conical flame, is used principally in marine work and to some extent in stationary practice. The steam atomization burner is used in stationary and locomotive practice almost universally. It delivers a long flame, usually flat. The choice of burners for central-station furnaces therefore lies between the steam jet and the mechanical, the shape and design of the furnace influencing the type selected.

The furnace arrangement is the most important part of the boiler so far as economy of operation is concerned. If the air and oil are not properly mixed, it will be impossible to obtain proper combustion. It is important that the oil be completely burned before the cooling effect of the heating surfaces can operate to quench the fire. A large combustion chamber is of great advantage in an oil-burning furnace, as the larger the combustion chamber the more complete the combustion will be before the gases are cooled.

Clean Burners and Furnace Maintenance Important.—Oil burners must be carefully watched as they are liable to become clogged with foreign matter or coated with carbon. This may cause the flame to shoot sideways, resulting in smoke and poor efficiency. Therefore a spare burner should always be kept on hand, so that as soon as any burner gives trouble it can be removed, taken apart and cleaned. All burners should be cleaned at regular intervals and adjusted so that the flame will not be projected directly against the boiler tubes or against the boiler setting, and so the flames from different burners will not interfere with one another.

The checkerwork in the furnace floor must be carefully placed and maintained in good condition. The air openings often become slagged over or stopped up by pieces of brick breaking off. Unless they are cleaned out occasionally and kept open for their full area, both the efficiency and capacity of the boiler will be reduced.

Regulating Atomizing Steam

Regulate Atomizing Steam to Suit Oil.—The regulation of the quantity of steam used for atomizing the oil

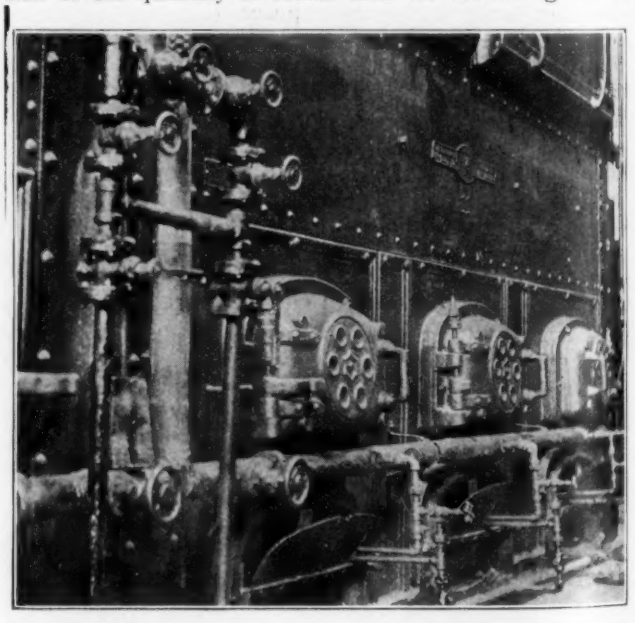


FIG. 4—OIL PIPING AND VALVES IN FRONT OF BOILER AT LONG BEACH PLANT OF SOUTHERN CALIFORNIA EDISON COMPANY

is a matter of very great importance, for if more steam is used than is actually needed there is not only a waste of the excess quantity of steam but there is also a loss

of the heat required to raise the temperature of this extra steam up to the temperature of the escaping gases. With careless operation the quantity of steam supplied to the burners sometimes amounts to as much as 5 per cent of the total steam generated by the boiler, whereas with proper care in operating this quantity can be reduced below 1 per cent.

A simple way to adjust the quantity of steam supplied is to gradually close down on the steam valve to the burner until drops of oil fall on the furnace floor. The drops burn and scintillate and can be readily seen, and this scintillation indicates that there is not sufficient steam to atomize the oil. As soon as this point is reached the steam valve should be opened just enough to stop the scintillating action.

The quantity of steam supplied to the burner bears an important relation to the furnace arrangement and the air supply, as both the shape and character of the flame change when the quantity of steam is varied. With too much steam an intense white flame is produced, which has a tendency to cause localization of heat on the brickwork or the tubes. With the proper amount of steam and correct air regulation a soft orange-colored flame is produced which fills out the furnace and has an appearance similar to that from a soft-coal fire. This flame will sometimes appear smoky in the furnace, but the smoke disappears before the gases reach the stack. It is therefore unnecessary to have an absolutely clear flame in the furnace.

A simple method of preventing too much steam being used for atomizing where boilers are operated at a fairly steady load is to provide a disk with a small hole in it in the steam burner line. This disk restricts the quantity of steam that can pass through the burner. The size of the hole in the disk depends on the steam pressure used and on the capacity required from the boiler and must be determined by experiment. In a plant using 200 lb. (14 kg.) steam pressure a hole $\frac{5}{16}$ in. (7.9 mm.) in diameter has been found large enough to supply all the atomizing steam required for a 600-hp. boiler. A by-pass should be provided on the steam line so as to pass steam around the disk in case it is found necessary to force the boiler at any time above its normal capacity. By providing the by-pass with a valve having a rising stem it can be seen at a glance whether the valve is open or shut.

Superheated steam should be used for atomizing wherever it is available, as the higher the temperature of the steam the more complete the atomization will be. The steam to the burner should always be cut down whenever the oil is cut down. Too often, however, the firemen leave the steam flowing full blast even after the oil has been reduced or shut off altogether. This is an absolutely unnecessary waste, though it is often necessary to keep a little steam flowing through a burner that is not in use, to keep it cool enough to prevent damage resulting from the heat of the furnace.

Proper Temperature for Atomization.—Oil should never be heated above its flash point, as in case of a leak in the oil pipe there will be danger of fire. However, atomization does require heating the oil to a temperature at which the viscosity is sufficiently lowered to make the oil very fluid. Overheating of an oil, due to its expansion, reduces the burner capacity to a considerable extent and also introduces the element of risk.

The proper temperature of the oil differs for different oils. California oils require heating to between 150 deg. and 180 deg. Fahr. (66 deg. and 82 deg. C.). The higher the temperature of the oil, the less steam is required to atomize it.

Operation of Boilers

Boilers Should Not Be Forced Excessively.—Boilers should never be forced unless absolutely necessary. If

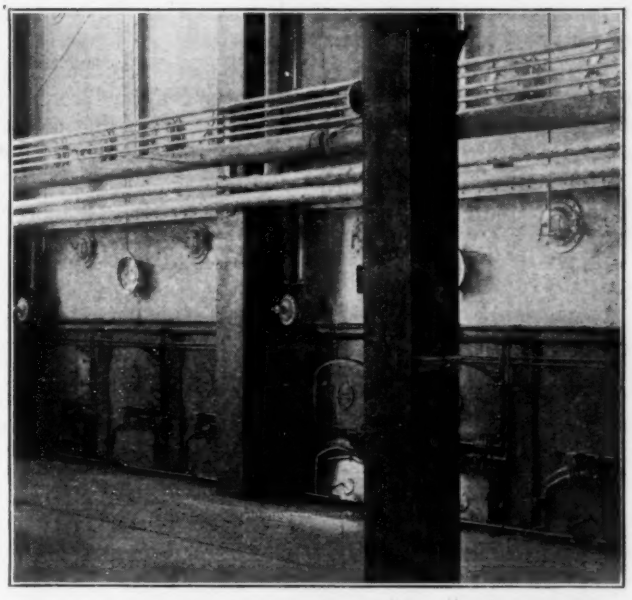


FIG. 5—OIL-FIRED PLANT OF SEATTLE ELECTRIC SERVICE COMPANY, WHICH CAN BE CONVERTED TO COAL OPERATION EASILY

there are not enough boilers in the plant to maintain steam pressure without forcing them, more boilers should be installed or the steam requirements should be reduced. In case of a variable load, it is permissible to force the boilers for short periods during peak load, but during the periods of lighter loads the same number of boilers should be kept in operation without forcing. Forcing of boilers results in high flue-gas temperature and should not be resorted to unless the plant is specially designed with this end in view and provided with economizers to absorb the excess temperature of the gases.

Shutting Down Boilers for Short Periods Should Be Avoided.—In case of a variable load it is more economical to keep the same number of boilers in operation continuously than to fire up extra boilers for the peak load. This means forcing the boilers somewhat during the peak, but it avoids the loss due to heating up the boiler settings, which is a considerable waste. It usually requires eighteen to twenty hours to heat boiler settings to their maximum temperature, so it is desirable to keep them in operation as steadily as practicable. In standby plants and plants that must be partly or wholly shut down during a portion of each day special precautions must be taken to prevent waste of oil during the shut-down period. As soon as the oil burners are shut off the ash-pit doors and dampers should be shut tight. If the dampers leak, they should be made tight. A boiler with a tight damper will maintain its full steam pressure for several hours after the fires are put out if no steam is drawn off. If the

damper leaks, the steam pressure will begin to drop immediately, and much more oil will be required to heat up the boiler when it goes back into service.

Oil Should Not Be Sprayed Into Furnace Unless There Is a Fire.—In operating oil-fired boilers it is extremely important to avoid any accumulation of gas in the boiler setting because of the danger of explosion; consequently no oil should be allowed to get into the furnace unless there is a fire to ignite it and no more oil should be fed into the furnace than can be burned with the available quantity of air and atomizing steam.

To light an oil fire under a boiler, first open the damper and ash-pit doors; next place a lighted torch in front of the burner; next turn on the atomizing steam; next turn on the oil, which should immediately ignite. If the oil does not ignite immediately, turn it off at once and investigate to find out the reason before turning it on again.

Feed Water Uniformly.—Water should be fed to the boilers continuously and uniformly. If it is fed intermittently, it may become too hot in the feed-water heater to absorb all of the heat in the exhaust steam, and at other times it will be too cold, thus causing considerable waste. Intermittent feeding also results in unsteady steam pressure, which in turn means frequent altering of the fires, variable furnace temperature and increased difficulty

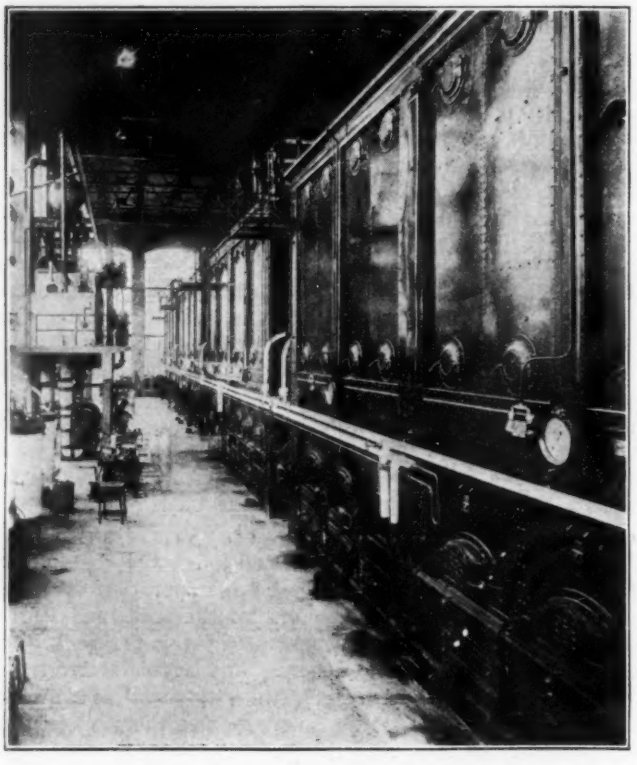


FIG. 6—AUTOMATICALLY CONTROLLED OIL-BURNING BOILERS AT BUSH STREET STATION OF GREAT WESTERN POWER COMPANY

The master controller is at the extreme right and not shown.

in regulating the air supply. For best efficiency the furnace conditions should be kept as steady as possible. It is better to allow the steam pressure to vary a few pounds than to be continually altering the fires.

Keep Boilers Clean and in Good Repair.—The importance of keeping the boiler clean both inside and outside and in good repair is recognized by every operating engineer and need not be enlarged upon here. There are some engineers, however, who, while realizing that the

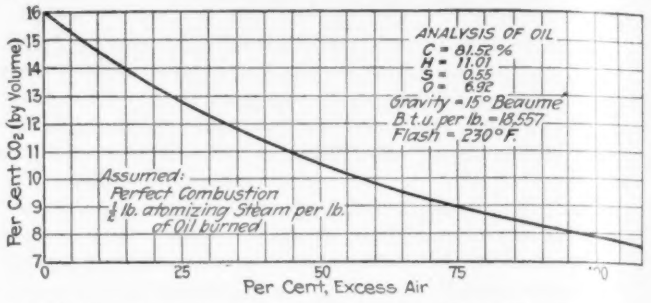


FIG. 7—MAXIMUM CO_2 FOR A GIVEN EXCESS OF AIR

In the most efficient steam plants at least 6 per cent of the heat of the oil goes up the stack when 50 per cent excess air is used in burning the fuel oil. Think what such losses mean in dollars and cents. Yet this vast loss with proper care may in large measure be avoided. In the average commercial plant losses far in excess of this are encountered. Hence at least 10.5 per cent CO_2 is most desirable. The best Pacific Coast steam-power plants obtain as high as 14.5 per cent without allowing the formation of CO.

boilers must be kept clean, are of the opinion that the quantity of soot resulting from an oil fire is so slight as to be negligible. Experience shows, however, that this is not the case, and it is essential to provide either mechanical soot blowers or some sort of steam lance with all oil-burning boilers. Furthermore, it is essential that these devices be used at intervals frequent enough to keep the heating surface of the boiler free from deposits of soot. In actual practice it is found that blowing the soot from the tubes of an oil-fired boiler results in a reduction in flue-gas temperature of 80 deg. to 100 deg. Fahr. (45 deg. to 55 deg. C.), which means an increase in efficiency of 1½ to 3 per cent.

The inside of the boiler must be thoroughly washed out and all scale removed at regular intervals, the length of interval depending on the quality of feed water used. Scale should not be allowed to accumulate more than ⅛ in. (3.2 mm.) thick. The soot on the outside of the boiler should be blown off at least once a day. Scale and soot constitute extremely efficient heat insulation materials, the thermal conductivity of scale being about one fifth that of steel so that ¼-in. (6.4-mm.) of scale is equivalent to a boiler tube 1¼ in. (3.2 cm.) thick.

The boilers should be blown down regularly at least once a day, and oftener if the water contains soluble salts which tend to cause foaming. About half a gage glass of water should be blown out each time, and this should preferably be done when there is no fire under the boiler. Samples of water drawn from the boiler should be tested for salt, which should not be allowed to concentrate above 150 grains per gallon (2.53 gm. per cu. dcm.).

Baffles and Flame Plates

Maintain Baffles and Flame Plates in Good Condition.—If boiler baffles are allowed to become displaced, the gases will short-circuit from one pass to another, making some portions of the heating surface ineffective. This results in high stack temperature and poor economy. The baffles should be kept gas-tight at all times, and any baffle tiles that have been disturbed by the replacing of tubes, gas explosions or from any other cause should be

put back into proper condition before the boiler is fired up. The openings through the baffles for the passage of gases should be maintained the right area to suit the capacity required and the draft available.

Use Recording Instruments Wherever Practicable.—Reliable records of the actual performances of a plant are of great aid to its efficient operation. By this means guesswork is avoided and it can be determined accurately what method of operation or which man produces the greatest efficiency. To obtain efficient results means not only the installation of efficient machinery and recording apparatus but constant attention to operation.

Recording CO_2 meters or an Orsat apparatus and draft gages are essential for efficient furnace operation, because they show excess air entering the furnace—the greatest single avoidable loss in the combustion of fuel. Recording steam gages and flow meters are also of considerable assistance, the latter particularly because they show the quantity of steam generated by each boiler. A pyrometer or flue-gas thermometer should be used to measure the temperature of the exit gases. An additional steam-flow meter should be connected to the atomizing steam pipe and a record kept of the quantity of steam used by the burners. Draft gages and recording pressure gage on the steam and oil lines close to the burners also give valuable information.

Determine Efficiency Daily from Records.—The actual evaporation per pound of oil may be obtained by means of water meters and oil meters. The quantity of steam used by the burners may be obtained by means of a steam-flow meter of the steam-to-burner line. The greater the net evaporation per pound of oil, the higher is the efficiency of the boiler.

By keeping accurate records of the daily performances of boilers it is possible to compare one day's results with another. By trying different methods of operation, different furnace arrangements and different intensities of draft and comparing one with another, the best and most economical method of operating may be determined with certainty.

Fire Boilers Scientifically.—Boilers should be fired scientifically; that is, by basing the method of operation on the flue-gas analysis, temperature of escaping gases and results of tests and plant records. With careful attention paid to the draft readings and adjustments of dampers, this method will usually result in considerable saving. The recognition that trained engineers are rapidly receiving is most convincing testimony that the value of scientific management is becoming increasingly appreciated.

Co-operation with the employer and with other employees is absolutely necessary for successful operation of the plant. If the plant requires new equipment or repairs to old equipment in order to improve its economy, these improvements should be suggested to the employer, with an explanation of the resulting advantages.

Safeguarding Coal Supply for the Future

How the Union Electric Light & Power Company of St. Louis Bought and Is Operating a Large Mine to Protect Itself in Quality, Supply and Cost of Fuel for Its Steam Station

THE question of whether a large central-station company should buy and operate a coal mine in order to safeguard its fuel supply and if possible reduce the cost is one that some companies have answered and that others are facing. One of the companies which decided that the purchase, development and operation of an extensive coal-mining property is in their interest is the Union Electric Light & Power Company of St. Louis.

While the reasons which led this company to make its decision are naturally based on the individual conditions prevailing in its case, they are also in some respects general in character. It is an example where a company is particularly fortunate in being close to desirable coal fields and where the problem of transportation is complicated only by the confused conditions which to-day hamper all freight transportation.

Sources of Union Electric Company's Power

As is well known, the Union Electric Light & Power Company obtains part of its power from the hydroelectric station of the Mississippi River Power Company at Keokuk, Ia. Its steam plant in St. Louis is operated on fuel obtained from the nearby coal fields of central and southern Illinois. In these districts the demand for bituminous coal of domestic sizes formerly exceeded the demand for screenings. Consequently the company was able for a number of years to obtain screenings at a low price. The same condition existed in other large cities near these fields.

There was a gradual change in the conditions under which coal was marketed in the St. Louis district, and screenings became relatively scarce about 1915 or 1916. At least they were not obtainable in the quantities and at the prices previously existing. It was more and more difficult to accumulate from the various operators of coal mines enough excess screenings at low prices to meet the needs of the generating station. The poorer quality of the available screenings was also a factor which pointed clearly to a change in the market conditions.

Contributing to the circumstances which required consideration were the increased use of screenings in stoker-fired power plants and the extension of the area served by the Illinois coal fields. The effect was an increase in the market price of screenings even larger than the increase in the prices of prepared sizes of coal. At the same time the fuel requirements of the company were showing a steady annual increase with the growth of the business.

Adequate Supply of Coal Essential

In view of these different considerations it was decided to be necessary for the company to provide itself with an adequate and economical supply of coal not so directly dependent on fluctuating market prices as under the conditions which had developed. Through its own organiza-

tion the company conducted over a period of four to five months an investigation of available coal properties and lands. The coal from fields nearest to St. Louis was found not to be so good in quality as that a little farther away.

Company Acquires Coal Lands

In January 1917, after an investigation of various coal properties and an extensive examination of all of the possibilities which warranted judgment from the economic standpoint, the company acquired several tracts of land about 80 miles (128 km.) from St. Louis in the Duquoin district. No coal was being produced then from any of the lands acquired.

After exploration a plan of development was designed for the property which will make it one of the most important producers in Illinois. Actual production was begun in the fall of 1918. The area of coal land owned and controlled is 3139 acres. It is estimated that the quantity of coal in the tract is sufficient to yield an output of 1,000,000 tons a year for a period of more than thirty years.

To own and operate the mine and to market sizes of coal not wanted for consumption in its own station the company incorporated under the laws of Missouri the Union Colliery Company. It owns all of the stock and bonds of this company. The colliery company has a nominal capital stock of $500,000, of which $250,000 is outstanding, and an authorized issue of $500,000 bonds, all of which are outstanding. Eugene McAuliffe, a well-known coal man, is president of the colliery company.

Further protection is obtained by the electric company under its plan of having direct control of the mine operation through an organization assembled and developed for that purpose. This practice avoids the difficulties which might arise in cases where a mine owned by an electric company is operated on behalf of the company by a coal dealer who markets on his own account domestic and other sizes of coal. In such cases the remaining costs of production chargeable to the portion of the mine output used by the electric company may be difficult to compute.

The tract is traversed by a main line of the Illinois Central Railroad. With an adequate supply of cars it would be in close connection with the various tributary markets for coal. Some of the miners who man the mine live at Duquoin, but the village of Dowell, with a population of 300, has grown up at the mine itself since operation began. Land and housing developments have been started. The company has not conducted these developments, which have been carried out by bankers and real estate men in nearby communities.

The mine is completely electrified and its equipment is of the most modern type. Power is received from the circuits of the local utility. Electrical features of the mine are not unusual, but they are particularly well adapted to the requirements and have been installed with greater regard for effectiveness than in the usual mining installation.

Charles S. Ruffner, vice-president of the Union Electric Light & Power Company, said to the Electrical World, in discussing the operation of the property and the policy adopted:

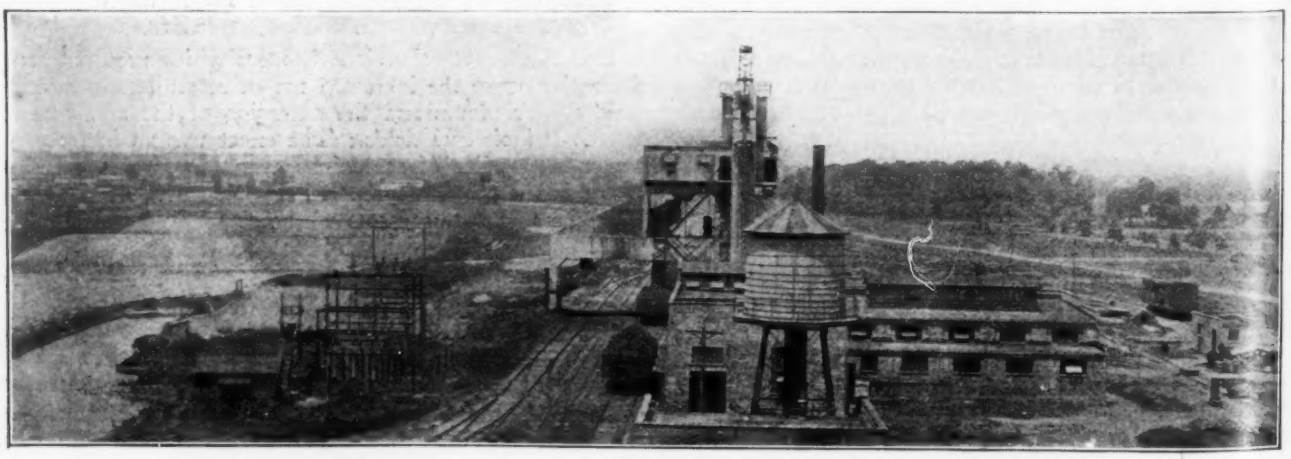
"Regular shipment of coal was begun on Jan. 1 of the present year and outputs in excess of 1300 tons a day have been attained already. When the underground work has been expanded to provide the necessary working faces the mine will be capable of an output of 8000 tons a day. The economical operation of the equipment and the saving due to the mining methods employed have been gratifying even in the early stages when output was much less than capacity.

"The mine will produce lump and nut coal in addition to the screenings, and so long as this is not needed for our own generating station it will be marketed. The policy will be to market it, as most mines do, through jobbers and retailers, who will deal directly with the Union Colliery Company.

"We feel that the purchase and operation of the mine is excellent policy. While all of the conditions of the future cannot be foreseen, it is within the possibilities that ultimately we may find it most profitable to crush all of the coal and use it in that way. At any rate, we are placed in a position to take advantage of the diversities in coal conditions as they develop."

Market Price of Fuel Stabilized

In making accessible so large a quantity of coal which can be mined cheaply there has been added an important factor tending to stabilize the price of fuel in this market, and particularly the cost of fuel of the electric company. The cost of coal used by that company will not be subject to fluctuations excepting those due to mining and transportation conditions but will be independent of special market or industrial conditions.



Electric Brass Furnace Reduces Foundry Costs

Actual Operating Costs and Performance Data from Rotating Non-Ferrous Furnace Installed in Jobbing Brass Foundry—Comparison Made with Gas-Fired Crucible Used at Same Time and Place

OPERATORS in brass rolling mills have enjoyed the advantages and economies of electric melting for years, but until recently the successful electric furnaces on the market were too large for the great majority of brass foundries. Now, however, non-ferrous electric furnaces can be obtained to melt heats of 250 lb. (113 kg.) or less. Leitelt Brothers of Chicago were among the first to install such a furnace in a brass foundry, and the operating records of their furnace are now published for the first time. As the furnace is operated only one shift a day, the kilowatt-hours consumed per ton of brass is much higher than the energy consumption of rolling-mill furnaces which are operated twenty-four

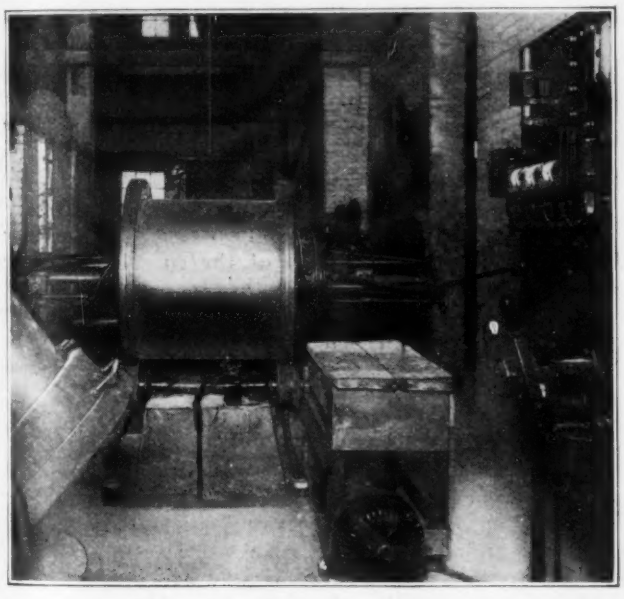


FIG. 1—250-LB. ROTATING ARC-TYPE NON-FERROUS FURNACE AND CONTROL

The electrodes are at the axis of the furnace, which is rotated or rocked as desired by the 2-hp. motor in the foreground. The push-button control on the top panel of the switchboard operates this motor. The bottom panel is used to control the supply of energy to the furnace. The leads to the furnace may be seen where they leave the ground in front of the furnace.

hours per day. The foundry conditions are also against the most efficient operation of this electric furnace, but nevertheless the inherent advantages and economies of electric melting are more than sufficient to compensate for the increased energy consumption and the adverse foundry conditions.

Leitelt Brothers installed a Booth rotating arc-type furnace and poured the first heat on May 17, 1919. The furnace is rated at 250 lb. (113 kg.) per heat, but has a maximum holding capacity of about 350 lb. (159 kg.). It cost in the neighborhood of $3,000; the reduction effected in the cost of melting should pay for the installation in about one year. Up to the time these data were collected no special attempt had been made to operate the furnace economically. For instance, at times the charge was not poured until half an hour after it was ready, while at other times the electrodes were left without adjustment for so long a time that they were too far

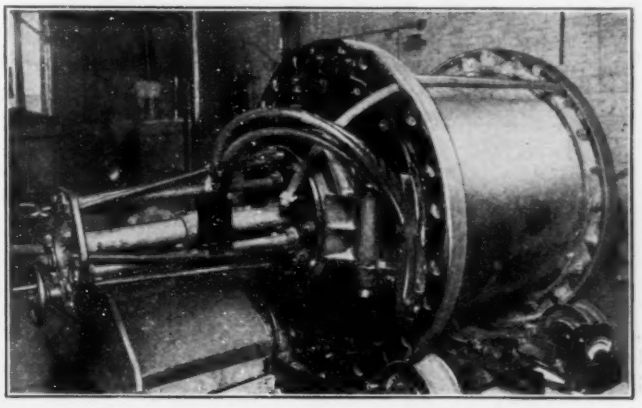


FIG. 2—FURNACE CHARGED AND READY TO RUN

This shows the charging door, the flexible cables from the track to the electrode holder and the water connections for cooling the electrodes. It is not necessary to open the charging door until after the heat is poured.

apart to sustain the arc, and the furnace cooled appreciably before the operator returned. These conditions are referred to because they are responsible for some of the high energy consumption which may be noted in Tables I and III. In the comparative costs, Table III, 480 kw.-hr. per ton is used against a gas consumption of 18,600 cu. ft. (520 cu. m.) per ton. In this comparison

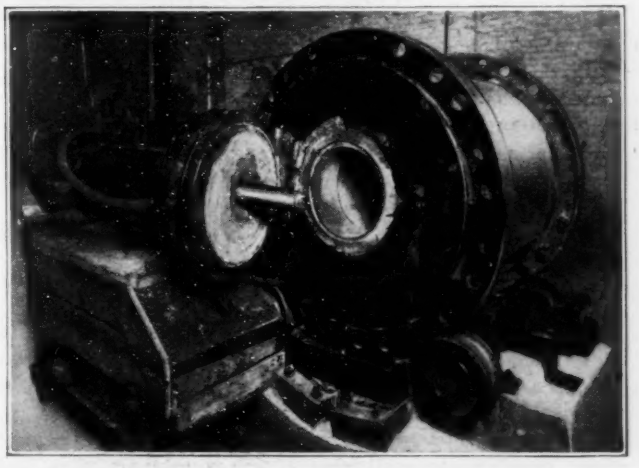


FIG. 3—DOOR OF FURNACE OPEN TO SHOW ELECTRODE

the electrical energy is taken at about the maximum average, while the gas consumption is nearer the minimum, as will be noticed by referring to the tests shown in Table II. Tht foundry expects much better electric furnace results when it gets properly organized, and electric

melting costs will probably be further reduced by the employment of a high-grade furnace operator.

Notwithstanding all the unfavorable conditions under which the electric furnace is being operated, it is showing a saving of more than 36 per cent in melting costs over those obtaining in the gas-fired crucibles. The electric furnace and the crucibles are operated side by side, and the comparative melting costs for the month of June were as shown in Table III. The lining cost of the electric furnace is given as $1 per ton. This is based on a life of 400 heats, whereas the lining had poured 425 heats and looked as good as when first put in. It is made of fireclay brick.

This is a very small furnace compared with most of those now in use and from which data have been published. The furnace can, however, melt red brass and gunmetal with less than 290 kw.-hr. per ton and can melt yellow brass with about 240 kw.-hr. per ton when the furnace is hot and when it is properly operated. It should be remembered, however, that the furnace is used only for one shift of nine hours a day and is allowed to cool down at night. This necessitates preheating with about 50 kw. for an hour before the furnace is charged in the morning. Even this is not sufficient to heat up the furnace thoroughly, and it is not until afternoon that the furnace reaches its point of highest efficiency and power factor. The average power factor of 71 per cent shown in Table IV could probably be increased to 80 per cent.

Foundry records obtained while a furnace is hot are very misleading. In a foundry such as the one referred to the average energy consumption will probably be more than 50 per cent in excess of the kilowatt-hours per ton when melting under the best conditions, but the foundrymen want to know average operating results rather than records obtained under favorable test conditions. The electric brass furnace has proved itself to be a practicable piece of foundry equipment, irrespective of its energy consumption, according to Leitelt Brothers, but foundrymen are not to forget the over-all economies effected and to think only of the cost of electrical energy if they find the kilowatt-hour consumption materially higher than was represented to them in pre-sale negotiations.

The salient advantage of the electric furnace which overshadows all others is that it can melt brass with less

TABLE I.—SUMMARY OF DAILY RESULTS WITH 250-LB. ELECTRIC ROTATING BRASS FURNACE, JUNE 3 TO JUNE 14, INC.

Day in June 1919	Heating Period: Heats	Heating Period: (Minutes)	Material	Charge, lb.	Poured, lb.	Shrinkage: Lb.	Shrinkage: Per Cent	Kw.-hr. per Ton
3	6	59	Yellow brass	262	259	3	1.15	550
			Red brass	1,442	1,426½	15½	1.07	368
			Day's run	1,704	1,685½	18½	1.09	394
4	7	53	Yellow brass	710	700½	9½	1.34	338
			Red brass	963	955½	7½	0.78	648
			Day's run	1,673	1,656	17	1.02	515
5	8	55	Yellow brass & manganese bronze	400	392½	7½	1.87	300
			Red brass and 85% copper bronze	1,458½	1,440	18½	1.27	428
			Day's run	1,858½	1,832½	26	1.40	400
6	8	57	85 per cent copper bronze	502	498	4	0.80	430
			Yellow brass	425	419	6	1.41	339
			Red brass	925	921¼	3½	0.38	416
			Day's run	1,852	1,838½	13½	0.73	402
Sat. 7	5	65	Yellow brass	164	162½	1½	0.91	293
			Red brass and 85% copper bronze	1,012½	1,003½	9	0.89	544
			Day's run	1,176½	1,166	10½	0.90	510
9	6	65	Red brass and 85% copper bronze	1,367¾	1,365	2¾	0.22	508
10	7	61	Red brass and 90% copper bronze	1,723	1,698	25	1.45	459
11	7	58	Yellow brass borings	83	74	9	10.83	867
			Red-brass scrap	1,697	1,674½	22½	1.33	368
			Day's run	1,790	1,748½	31½	1.80	391
12	7	51	Yellow borings	200	169	31	15.50	500
			Yellow-brass scrap	1,225	1,221¾	3¼	0.27	488
			Day's run	1,425	1,390¾	34¼	2.40	504
13	7	54	Yellow brass	125	107	18	14.40	384
			Red brass and bronze	1,494	1,490½	3½	0.23	380
			Day's run	1,619	1,597½	21½	1.33	381
14	4	62	Red brass	977	972½	4½	0.44	442

SUMMARY

Red brass and 85 per cent copper bronze	1,476¾	1,467¾	119½	0.81
Yellow brass	1,361	1,333½	27½	1.40
Yellow brass borings	408	350	58	14.21

Analysis of the borings charged shows:

	Per Cent.		
Oil	8.28		
Non-metallic	5.38		13.66
Metal	86.34	Net metallic shrinkage	0.55

Average power consumption ..... kw.-hr. per ton 441

loss than can the fuel-fired furnaces. The gas-fired crucibles in this foundry show a total shrinkage of 30 per cent to 40 per cent when melting concentrates from floor sweepings which contain a considerable amount of dirt and moisture. The loss on similar material when melted in the electric furnace is only about 15 per cent, as practically all of the metallic content is recovered. With dry yellow-brass turnings and borings the loss in the electric furnace is less than 1½ per cent, as against an average loss of about 10 per cent in the gas-fired crucibles. The comparative losses with red brass are about three-fourths of 1 per cent in the electric furnace and up to about 4 per cent in the crucible furnaces.

TABLE II.—TESTS ON GAS-FIRED CRUCIBLES.

	Heat No. 1	Heat No. 2
Character of charge, red brass	Scrap	Scrap
Metal charged, lb.	165	250
Metal poured, lb.	156	245
Loss, per cent	5.75	2.04
Time, minutes	60	105
Gas used, cubic feet	2,040	3,560
Gas, cubic feet per ton	24,720	28,480
Average crucible consumption per ton, per cent	44	44

TABLE III.—COMPARATIVE COST OF MELTING BRASS IN ELECTRIC FURNACE AND GAS-FIRED CRUCIBLES DURING JUNE 1919.

	Electric Cost per Ton Melted	Gas Cost per Ton Melted
Pounds of metal poured during month	35,215	18,210*
Electric energy (480 kw.-hr.)	$13.64	.....
Gas (18,600 cu. ft.)	.....	$12.65
Labor	6.25	8.00
Lining	1.00	1.00
Crucibles	.....	7.00
Metal shrinkage:		
Electric, 1.31 per cent, at 18 cents	4.71	.....
Gas, 2.62 per cent, at 18 cents	.....	9.42
Electrode consumption at 27 cents per lb.	1.08	.....
Gas for heating ladle, 600 cu. ft. at 68 cents per 1000 cu. ft.	0.41	.....
Total	$27.09	$38.07
Saving by use of cheaper scrap made possible by electric furnace	2.88	.....
Average net melting cost	$24.21	$38.07

Average saving per ton melted in electric furnace, $13.86.

*Estimated.

TABLE IV.—RESULTS OF FOUR DAYS' TEST DATA FROM ELECTRIC MELTING

Date of test	June 11	June 19	June 24	June 25
Number of heats	6	8	4	1
Character of charge	Scrap	Ingot	Ingot	Gates
Weight charged, lb.	1,698	2,236	1,012	275
Weight poured, lb.	1,676	2,229	1,007	....
Loss, per cent	1.3	0.32	0.47	....
Energy per ton, kw.-hr.	354	412	474	436
Average power factor, primary	....	....	....	63
Average power factor, secondary	71	70	70	71
Average weight per heat, lb.	283	280	252	275
Melting time per heat, minutes	47	59.5	57	61
Copper charged, per cent	80.58	76.59	85.30	81.81
Copper poured, per cent	77.04	75.48	85.23	82.65
Lead charged, per cent	6.97	10.18	4.92	4.67
Lead poured, per cent	6.66	10.24	4.86	5.77
Tin charged, per cent	4.66	8.04	1.83	2.25
Tin poured, per cent	3.93	7.92	1.91	2.10
Zinc charged, per cent	7.09	3.28	8.11	7.91
Zinc poured, per cent	12.25*	2.93	9.46	9.94

*Zinc added in ladle.

The electric furnace is also able to melt turnings and borings with but slight loss. It had been found impracticable to use that kind of scrap in the crucibles, owing to the great operating inconvenience in handling and also to the high metal loss. Turnings and borings cost from 3 cents to 5 cents a pound (7 to 11 cents per kg.) less than ingots of the same analysis, and when charged into the electric furnace in large quantities this one item will greatly increase the saving effected by the electric furnace as shown in Table III.

A great variety of mixtures are poured from the electric furnace, and it is the exception rather than the rule to have many heats in succession of exactly the same material. The heats are also of widely different weights. Many short heats of less than 250 lb. (140 kg.) are run off economically. The mixtures used during a four-day test are shown in Table IV, which also gives the percentage loss of different alloys. The shrinkage on June 11 was comparatively high because all the charges on that day consisted of exceptionally dirty scrap. In a furnace as small as the one under consideration slight inaccuracies in weighing, or carelessness in pouring, may greatly affect the shrinkage records.

The low melting cost made possible with the electric brass furnace is a very important item. However, it is hardly less vital than the better and more uniform quality of castings made from electrically melted metal. Both gas and electric furnaces are still used in this foundry, and it is seldom possible to determine at some subsequent date from which furnace a defective casting was poured. However, definite data are available on a number of castings which had to meet navy specifications. Seventy-five per cent of the castings which were poured from the electric furnace passed inspection, but only 10 per cent of those poured from crucibles came up to the government's requirements.

ELECTRIC LIGHT AND POWER DERIVED FROM SMALL STREAMS

Development of Small Water-Power Sites Is Discussed—Estimating Load Requirement and Latent Energy of Stream

Many small water-power sites within easy reach of farms and small industrial concerns are neglected because it is not generally appreciated that their development is feasible. In order to stimulate the use of such small water powers the United States Department of Agriculture has recently issued a bulletin (No. 770) outlining the method of studying stream flow to find the amount of power which may be made available. The bulletin also gives information regarding the power requirements of interior lighting units, heating devices and farm machinery. A table giving the power required to operate different farm machines follows:

Device	Hp.	Device	Hp.
Cream separator	½	Corn sheller	½
Milking machine	½	Hay press	3
Wood saw	3	Thrashing machine	30
Washing machine	¼	Churn	½
Grindstone	¼	Ice-cream freezer	½
Ensilage cutter	10	Water pump*	1½ to 3½
Feed grinder	5		

* This depends upon the lift but generally falls within these limits.

Substation Construction in Southern California

Features of Torrance and Eagle Rock Substations Recently Built by the Southern California Edison Company to Help Take Care of Expanding Load

BY J. A. LIGHTHIPE
Chief Electrical Engineer Southern California Edison Company

THE Southern California Edison Company has its power market divided into two principal geographical parts, one being the fertile valley of the San Joaquin, extending from south of Bakersfield in the oil-well country north to above Visalia, in which is the center of a large and rapidly growing agricultural district. In this latter territory the Southern California Edison Company supplies a load having a maximum peak during the summer months, when there is a great demand for power to pump water for irrigation.

The other section of southern California supplied by the Southern California Edison Company is that south of the Sierra Madre and the Coast Range Mountains. This portion is some 200 miles (320 km.) long and has a width varying from 20 miles to 100 miles (32 km. to 160 km.). This territory was the first served by electrical energy and as a consequence has been more intensively developed. It is traversed by numerous transmission lines which reach every part of the six counties—Santa Barbara, Ventura, Los Angeles, Orange, Riverside and San Bernardino—where power is required. As is well known, this section comprises a large portion of the citrus-fruit territory of the state and produces in addition large quantities of other agricultural products. A close second to the farming interests is the industrial development. The Southwest manufactures nearly every article of commerce from ships to sugar and from automobiles to aeroplanes.

Owing to the rapid increase of load in the southern division of the Southern California Edison Company's system (peak load of this division will reach 175,000 kw. this year) it has been necessary to construct a new 30,000-kw. hydroelectric generating station to be known as Kern River No. 3, install an additional 16,000-kw. generating unit in the Big Creek No. 2 power plant, and construct a 50,000-acre-ft. (61,500,000-cu. m.) reservoir for impounding water to supply Big Creek No. 2. The power from these units will be transmitted to the San Joaquin Valley, thence to Los Angeles over the 150,000-volt lines of the Big Creek system. These lines terminate in the suburb of Los Angeles known as Eagle Rock. In this station transformer equipment and a 30,000-kva. synchronous condenser are to be installed.

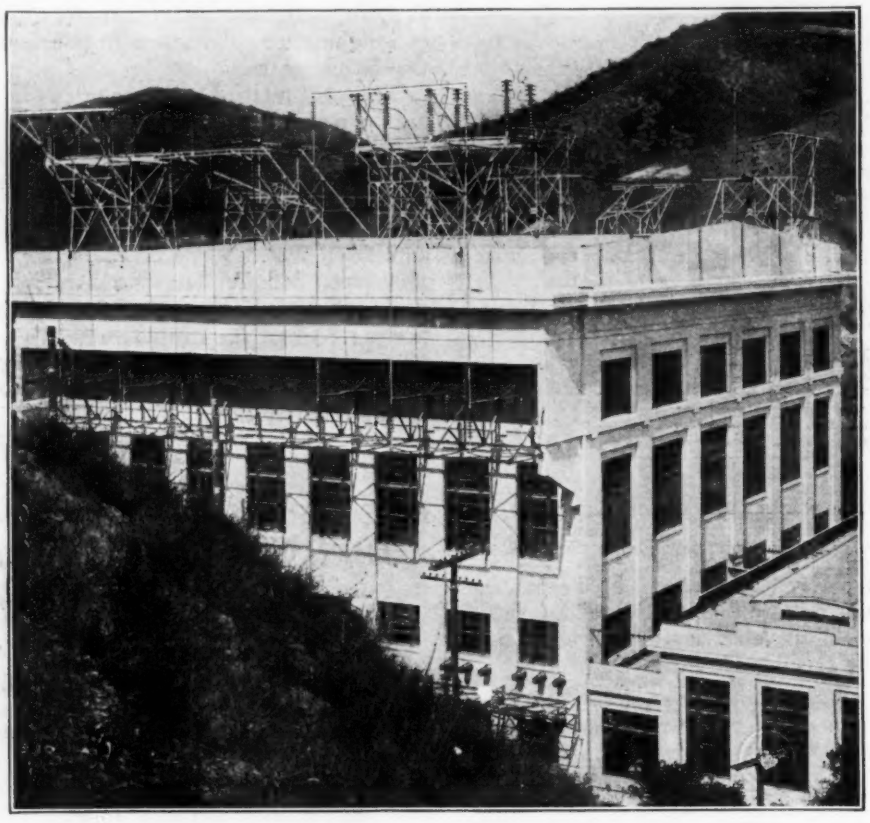


FIG. 1—EAGLE ROCK SUBSTATION, THE MAIN DISTRIBUTING POINT IN THE SOUTHERN DISTRICT OF CALIFORNIA

For transmission of power in the southern division 60,000-volt lines constructed of No. 4/0 or larger cable are used for the principal circuits. These lines interconnect the principal substations, such as Los Angeles No. 3, Newmark, Vernon, Katella, Colton and Capistrano. The latter two substations are points of interconnection with the Southern Sierras Power Company and the San Diego Consolidated Gas & Electric Company respectively. At these points power is interchanged through the medium of 5000-kw. frequency changers operating at 50 cycles on the Southern California Edison Company's system and at 60 cycles on the other two systems.

Since the principal low-tension distribution is at 15,000 volts, the voltage at which the local and interurban railways as well as the smaller distribution substations are served, it would be impracticable to distribute directly at this voltage from the main receiving substations owing to the distance involved. This fact and the increasing load of the industrial district between Los Angeles and Los Angeles Harbor require that the 60,000-volt network be extended and interconnected so that operation may be conducted with the minimum of loss and each load center supplied by more than one transmission line, insuring 100 per cent service. An adjunct to the construction of these lines is the feature of voltage control by means of synchronous condensers.

In addition new 60,000-volt lines are to be run from Eagle Rock substation to connect with a number of substations previously served by 30,000-volt lines. These lines will constitute a loop from Eagle Rock to the west of Los Angeles, and south connecting with the steam generating stations at Redondo Beach and at Long Beach. Where the loop is intersected by lines radiating from the Redondo steam plant the Torrance substation is being built. This will be the largest distribution substation on the system. The new Torrance substation and the additions to the present Eagle Rock substation each present several features of more than usual interest.

TORRANCE SUBSTATION

As mentioned before, Torrance substation will receive energy from Eagle Rock, Redondo and Long Beach at 60,000 volts and 15,000 volts. The initial installation will consist of ten 15,000-volt outgoing circuits, two 60,000-volt supply circuits and transformer capacity of 15,750 kva. The 60,000-volt switches, buses, lightning arresters and transformers are to be installed outdoors. The double 60,000-volt buses, switches, etc., are to be supported by a steel structure which is planned so that extensions may be made as the load increases. The rapid and continuous growth of the system load must always be in mind in the construction of all parts of the plant. Provision for this contingency is well illustrated in the design of the Torrance substation. The outdoor framework will provide space for the installation of one additional 60,000-volt line and a bank of transformers of 5000 kva. each. It is expected that a third bank will be required within the next two years, and the rack will be extended at that time.

The 15,000-volt apparatus is to be housed in a reinforced concrete building 55 ft. by 140 ft. (16.5 m. by

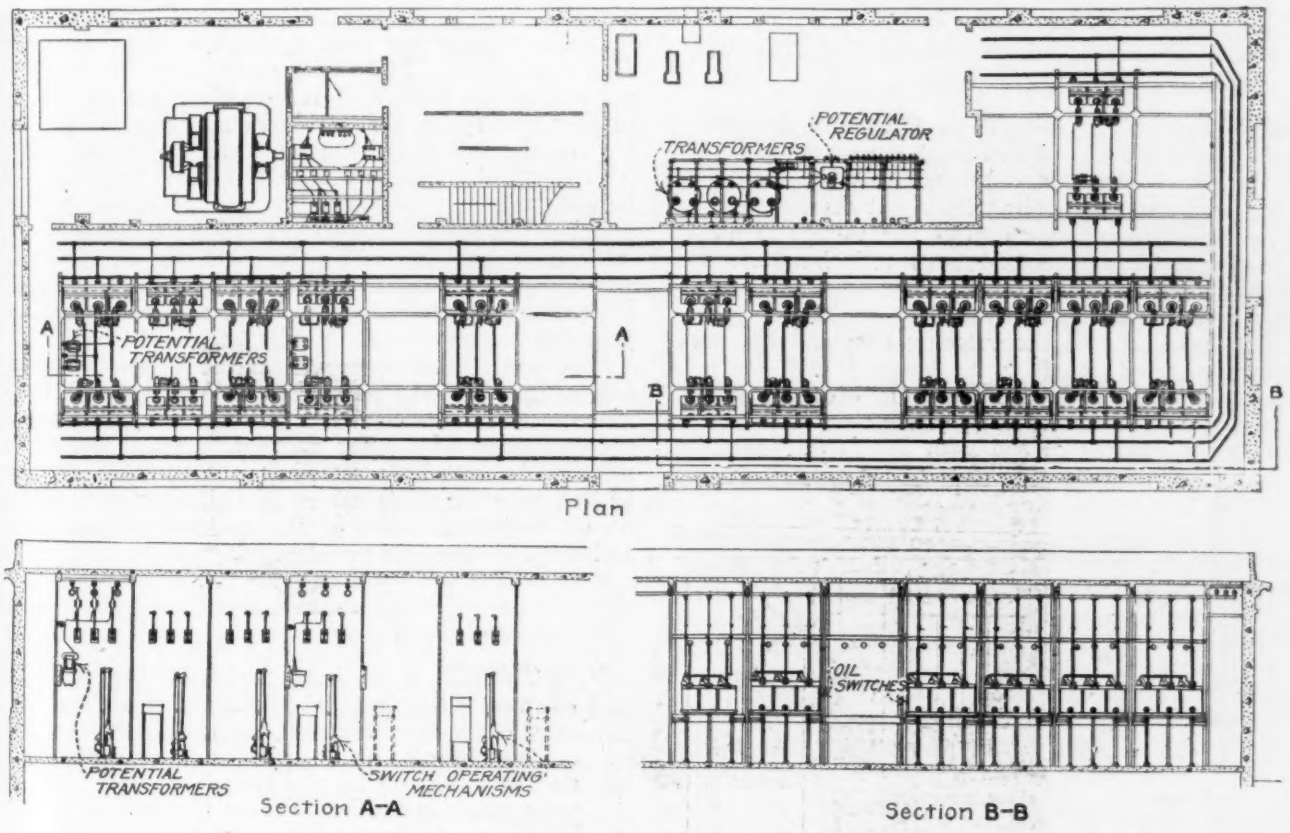


FIG. 2—ARRANGEMENT OF SWITCHES AND BUSES IN TORRANCE SUBSTATION

Cross-sections through bus and switch compartments.

42 m.). Circuits to and from this apparatus will enter and leave the building through bushings in the center of the roof. Duplicate 15,000-volt buses are provided with automatic oil switches to connect any line to either bus. A slight departure from the usual practice is made in the omission of disconnecting switches between the oil switches

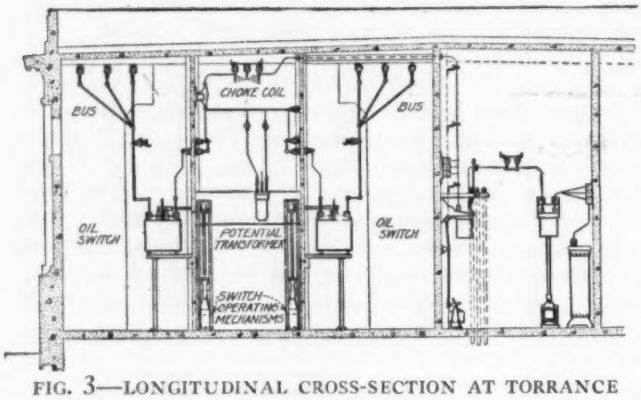


FIG. 3—LONGITUDINAL CROSS-SECTION AT TORRANCE SUBSTATION

and the buses. The object in this is to make it necessary to kill an entire bus when repairs are necessary on any of the oil switches. It is believed that the increase in safety will more than offset the slight decrease in flexibility. For power-factor control and voltage regulation a 6000-kva. synchronous condenser is to be installed. This machine is to be walled off from the other parts of the building to reduce the noise.

The incoming and the outgoing lines and the transformer switches are all to be equipped with the most suitable style of protective relays, in order to prevent undue opening of the switches at the time of the occurrence of a disturbance and with the further object of

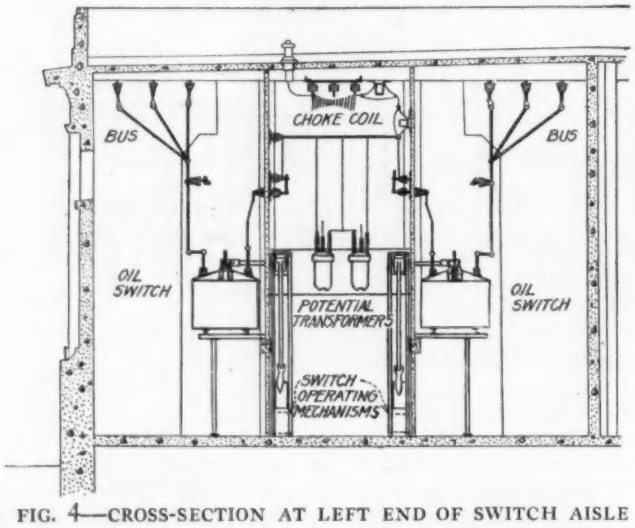


FIG. 4—CROSS-SECTION AT LEFT END OF SWITCH AISLE

removing as quickly as possible short circuits occurring on any of the lines. In particular, the 60,000-volt supply lines are to be equipped with unidirectional relays so that the switch connecting to the short-circuited line will open in preference to that connected to the good line, thereby giving the station a continuous supply of energy.

In the case of the 15,000-volt feeders, those isolated will be controlled by time-limit relays, while those operating in parallel at Torrance and at the receiving substation will be under the control of balanced relays.

EAGLE ROCK SUBSTATION

The accompanying photograph shows the present building of the Eagle Rock substation. This building is composed of two principal parts—first, a room for housing the synchronous condensers and the operating gallery; second, the high-tension switches and transformer compartments. No additions will be made at this time to the latter part of the building as there are already vacant line positions sufficient to take care of the 60,000-volt lines mentioned above. An addition is to be made to the condenser room to provide space for housing the 30,000-kva. machine.

At the present time the operation at Eagle Rock substation is to distribute energy at 60,000 volts and 15,000 volts, being transformed to these voltages from 150,000 volts. The equalization of the load between the 60,000-volt and the 15,000-volt buses is effected by transferring the load between the lines at stations receiving power from Eagle Rock. This separation of the 15,000-volt and the 60,000-volt buses will require the operation of the present two 15,000-kva. synchronous condensers on one bus and the new 30,000-kva. condenser on the other bus. The electrical characteristics of this latter machine will be such that it may supply the full output at leading power factor, or up to 20,000 kva. at lagging power factor. This machine will be under the control of an automatic regulator, and its operation will be based on the principle of constant voltage rather than that of power-factor adjustment.

The new condenser, as well as the present machines, will be equipped with such protective relays as will operate to remove the machine from the line immediately upon the occurrence of a short circuit or ground within the machine, between its leads or in the low-tension windings of its transformers. These relays will open the switches on the high-tension side of the condenser transformers, and also open the field switches.

JUSTICE is the bond that holds the community together, and justice means fair play to all—not privilege for any class. Neither capitalist nor labor organization shall exploit the community for its own special benefit. The wage earner is entitled to make the most of his life. So are the farmer, the trader, the teacher, the lawyer, the doctor. If the undertakers were to strike, who would bury our dead? If the teachers were to strike, who would teach our children? If the farmers were to strike, how would we escape starvation? Yet all have the same right to strike as the industrial workers. But if all struck the result would be chaos and death. The modern state, with its complex economic organization, has outgrown the crude weapon of strikes. We must learn to substitute for them conferences of all interests concerned and the rule of reason and regard for the public welfare.—*Dr. Jacob Gould Schurman.*

Readers' Views and Comments

Welding System Controversies

To the Editor of the ELECTRICAL WORLD:

SIR: Advocates of some particular types of apparatus for arc welding have shown a tendency to refer to other electric welding equipment in very uncomplimentary terms. This is not only unethical but it is damaging to the electric welding industry as a whole and does not appear to be justified by the facts available. Prominent independent investigators seem to agree that good welds can be made with all the different types of arc-welding equipment on the market. They say, however, that the results depend upon the operator to the extent of about 90 per cent, and only about 10 per cent upon the apparatus used. Under these conditions those interested in arc welding may well forget their prejudices and present a united front in perfecting those features which practical operation points out as possible of greater refinement. It is only through such co-ordinated efforts by all concerned that electric welding will be developed to its fullest extent and "system" controversies reduced strictly to their engineering merits.

Chicago, Ill. H. P. WALES.

Remote Control of Synchronous Machines

To the Editor of the ELECTRICAL WORLD:

SIR: With reference to various articles on automatic stations which have appeared from time to time in your paper and in the electrical press of America in general, I desire to make a few statements on the construction and operation of electric plants of this kind.

The problem of the alternating-current automatic station is to provide a system of remote control of synchronous machines; that is, of starting and properly synchronizing the same from a distant point. To start an alternating-current motor asynchronously at a distance is about as easy as closing a switch; to convert, however, a motor thus started into a regularly operating synchronous machine is a more difficult matter. The conversion from the asynchronous into the synchronous condition can be brought about essentially by two methods, applied to the dynamo during asynchronous rotation, which although not strictly differentiable from each other in all possible modifications and combinations, may be said to consist, first, in producing an unbalance of the fields in the two dynamo members and, second, in determining or otherwise utilizing the self-induction of the dynamo by a relatively weak excitation.

The first of these methods is a process of starting and synchronizing and consists more particularly in impressing a weak field upon the motor member acting as the secondary during asynchronous rotation, whereby the synchronous speed may be electrically "derived," as clearly described and specifically claimed in my U. S. patent, "Alternating Current Motor," No. 871,513, filed Sept. 7, 1905, granted Nov. 19, 1907. Claim 5 thereof refers to this method of starting and reads as follows:

"In combination with an alternating-current motor having two members, a stator and a rotor, means for producing a synchronous speed by simultaneously supplying alternating currents to both members of said motor, means for producing an asynchronous speed having only one of said members supplied by alternating currents, and separate means for deriving said synchronous speed by weakening one of the rotary fields which produce said synchronous speed."

The second method above indicated forms the subject matter of my U. S. patent No. 1,204,169, "Method of Synchronizing," filed May 27, 1907, granted Nov. 7, 1916. One of the advantages of this method, as pointed out in the specification, is that it renders the synchronizing and the starting independent of each other, a feature which is of the greatest technical and commercial value.

It is not sufficiently known that the ordinary method of synchronizing, which has now been in general use for more than a quarter of a century, is necessarily limited either to mechanically started synchronous generators and motors—that is, generators started by their prime mover and synchronous motors having a separate starting motor—or to rotary converters in case they are started by continuous current. According to the old practice of synchronizing, it is necessary to produce in the dynamo, when asynchronously rotating, a fully excited field, which, being out of synchronism, will naturally interfere with any process of starting by alternating currents.

Synchronous machines, including rotary converters when started by alternating currents in the ordinary way, will merely fall in synchronous step without necessarily assuming correct polarity, which is an absolute requirement for proper synchronous operation. In case of wrong polarity, occurring with a probability of one to two, it becomes necessary either to reverse the field circuit or to cause the machine to slip a pole, whereupon the field excitation may be established and the machine brought to regular synchronism. This procedure, however, requires personal judgment and is unfit or at least too complicated and unreliable for remote control or automatic operation.

My patent No. 1,204,169 relates to an entirely new art of synchronizing by means of self-induction. Its scope is defined by eleven carefully worded claims covering more than I have been able to outline in the foregoing. This patent comprises among other things the automatic station in general and the automatic substation in particular, as well as the most valuable methods of starting synchronous motors and rotary converters, which have successfully stood the test of actual practice. The particular methods applied in each of these practical applications are but specific modifications of one and the same fundamental invention which is described and claimed in this patent. In order to enable any one familiar with this matter to prove the correctness of this statement, I am able to cite one of the claims of this patent, for instance Claim 2, which reads:

"The new art of synchronizing a dynamo with a current source, which consists in preliminarily connecting both members of said dynamo with a part of the voltage of the source, and supplying normal operating current to said dynamo at an instant which is characterized by a critical inductive behavior of said dynamo when preliminarily connected."

I hope that this communication, which has been delayed by conditions of war, will bring to light at least a part of the underlying work which I have done in this rapidly developing field of the electrical industry.

Berlin, Germany. CARL A. LOHR.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

FLEXIBLE SUSPENSION CLAMPS PREVENT LINE-WIRE BREAKAGE*

Precautions by San Diego Consolidated Gas & Electric Company to Guard Against Repeated Failure of Line

Breakage of line wires caused much trouble for a time to the San Diego Consolidated Gas & Electric Company on the transmission line following the California seacoast between Del Mar and Oceanside, north of San Diego, the failure being found to occur at the suspension clamps.

In nearly every case of trouble the break was found to be about ½ in. (1.3 cm.) outside the end of the grip portion of the clamp. Wire samples adjacent to the breaks were tested, and it was found that the strength complied with the American Society of Testing Materials specifications and was therefore not at fault. This 66-kv. transmission line having No. 2 solid medium-hard-drawn bare-copper line wires with standard spacing of 350 ft. (105 m.) was installed in the summer when the temperature was 70 deg. Fahr. to 75 deg. Fahr. (21 deg. C. to 24 deg. C.). At this time the line was carefully sagged, care being taken to provide what seemed to be ample factors of safety for winter conditions of the extreme kind.

As the breaks occurred outside of the grips it would seem that they could not be the result of roughness of the clamp or too tight a grip. It was noted, however, that a slight wire-drawing effect evidently preceded the break in each case, and therefore the deduction was made that the clamp was holding the wire too rigidly and that the swaying of the line in the wind caused a repeated bending just outside the point of attachment, which resulted in the final breakage.

The original clamps were of a one-piece type, having a clevis for attachment directly to the bottom insulator stud. These were replaced by a two-piece clamp having a link between the clamp proper and the clevis, thus giving full flexibility in all directions. Moreover, the clevis at the top of the string was replaced with an I-bolt, and the clamp was bushed with sheet copper as an additional precaution. While these changes were being made the wire was carefully examined at each clamp. A number of drawn places where failures would soon have occurred were found by the examiners and were eliminated.

Since this inspection there has been no failure on the line, and it is thought that of the three remedial measures taken, the substitution of the two-part flexible clamp for the previous rigid clamp was the one which really obviated the difficulty.

San Diego, Cal. L. M. KLAUBER.

* Excerpt from one of the "operating difficulty" papers presented at the Pacific Coast A. I. E. E. convention.

TESTS SHOW THAT CABLES REQUIRE CAREFUL HANDLING

After Bending 180 Deg. Around 11-In. Mandrel the Breakdown Voltage of Cable Was Considerably Reduced

A recent investigation on No. 2/0 single-conductor cable with impregnated paper insulation 5/32 in. (4 mm.) thick showed signs of defects at 15,000 volts. Increasing the pressure 2000 volts per minute resulted in a minimum breakdown voltage of 32,000 volts and a maximum of 48,000 volts in thirty-two tests, *i.e.*, 200 volts to 310 volts per mil. Duplicate samples were bent 180 deg. around an 11-in. (28-cm.) mandrel, straightened and reversed three times. The lowest breakdown voltage was then found to be 15,000 volts and the highest 30,000 volts. Before bending the best test was 50 per cent above the lowest, while after bending it was 100 per cent. This fact emphasizes the need of careful handling. All the samples were 10 ft. (3 m.) long.

ONE-POLE OUTDOOR SUBSTATION

Can Be Built for $300, Exclusive of Transformers and Lightning Arresters

The substation layout shown in the accompanying illustration has been devised by T. F. Johnson, general superintendent of electrical department, Georgia Railway & Power Company, Atlanta, Ga., for use in serving small loads. The layout has been arranged so that the last pole in a line can be used. All equipment except transformers,

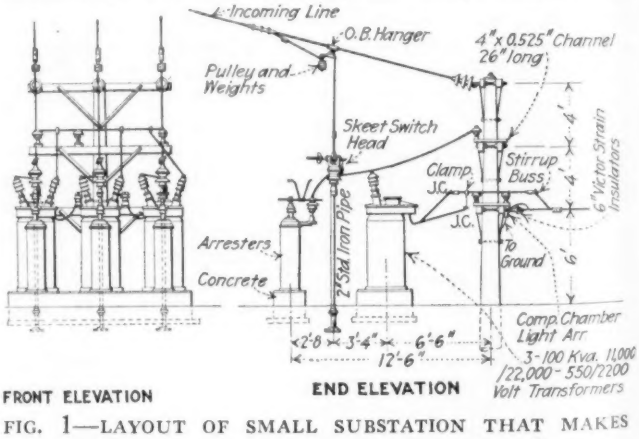


FIG. 1—LAYOUT OF SMALL SUBSTATION THAT MAKES USE OF AUTOMATIC SWITCH OF FIG. 2

oil switches and lightning arresters is conveniently packed in a box so that this material can be carried to the location in a truck. It is estimated that the complete installation without transformers and lightning arresters can be built for $300.

An interesting feature of this substation is the automatic

disconnecting switch which makes a connection to the incoming transmission line. A detailed sketch of the automatic operation of this switch is shown in Fig. 2.

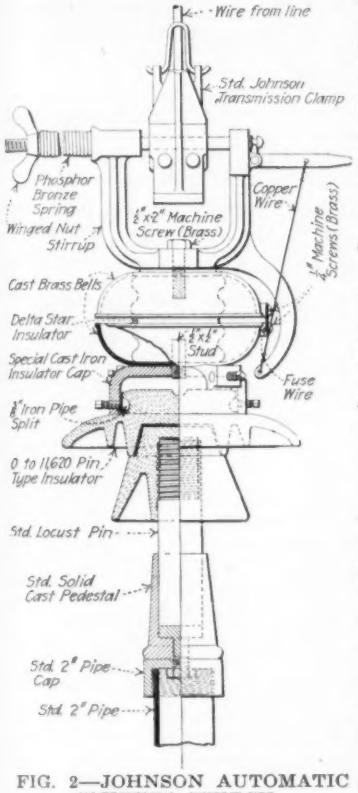


FIG. 2—JOHNSON AUTOMATIC "SKEET" SWITCH

As shown in Fig. 1, the switch head of Fig. 2 is mounted on a standard 2-in. (5-cm.) iron pipe and provided with insulators bearing at the top a special stirrup. To this stirrup a Johnson transmission line clamp is attached. It will be noticed that the bar of the stirrup is held in position against a spring by a lever and copper wire. Between the stirrup and the head of the insulator to which the connections to lightning arrester and oil switch are made is a fuse. When this fuse blows it also melts the copper wire in contact with it, and that releases the pin in the stirrup so that the weight of the cable to which the Johnson clamp is connected draws the latter up to the top point and disconnects the load.

A sketch of the automatic features shown in Fig. 2 is a preliminary design which is now being experimented with by Mr. Johnson. In its final form it will bear several improvements.

STANDBY BATTERY FOR REMOTE-CONTROL OPERATION

How Problem of Protecting Pilot Lamps from Over-voltage Was Accomplished Without Interfering with Oil Circuit Breaker

Standby energy for the operation of the remote-controlled circuit breakers and the pilot lamps at the Nisqually substation at Tacoma, Wash., is furnished by a storage battery which floats on the line continuously. For normal operation and for charging the battery energy is supplied by a motor-generator set and the battery is never discharged except in an emergency. The cells are equalized once every two weeks. Since the floating voltage of the battery is from 2.10 volts to 2.14 volts per cell, it was necessary to insert resistance to protect the graphic meters and pilot lamps from over-voltage. The resistance orginally used was a grid with a standard rheostat head which protected the devices, but this did not allow enough current to pass to operate the oil circuit breakers. In order to overcome this difficulty, counter cells were installed, some of which were built up out of old battery elements. These cells reduce the voltage but at the same time permit a sufficient flow of current to operate the breakers. There are twelve counter cells divided into three groups of four each, with taps taken off so as to permit the cutting in or out of one or more groups as may be desired. They are so connected that the current passes through them from positive to negative, thus continuously charging them.

The operation of the graphic meters and pilot lamps requires a continuous flow of about 7 amp. through the counter cells, which causes a rapid evaporation of the water as well as the deterioration of positive plates. This trouble was obviated by connecting a 6.6-amp. series-incandescent lamp across each group of four cells. This shunts 6 amp. away from the cells, reducing the current flowing therein about 0.5 amp. or 0.75 amp. and at the same time affording illumination at certain points where it is needed in case of an emergency.

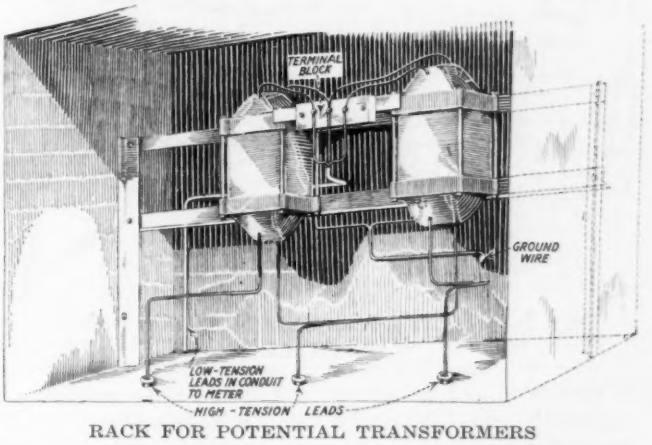
In operating one of the circuit breakers the current momentarily reaches a value of 7 amp., thus subjecting the lamps to an over-rush of current. In order to correct this condition three more cells are to be added, thus making a total of fifteen. They will be divided into three groups of five each, and a short piece of resistance wire will be installed in series with each lamp so as to limit the current to 6 amp. A snap switch is installed on each lamp so that when the battery is receiving its equalizing charge the lamp can be cut out. This causes the counter cells to build up to their highest voltage at the time when it is most needed.

F. S. Morrison is chief operator of this station.

A FRAME MOUNTING FOR POTENTIAL TRANSFORMERS

Used Where Apparatus Is Installed in Compartments—Block Attached to Transformer Frames Supports Terminals

For mounting potential transformers in compartments one central station in the East uses the angle-iron framework shown here. The framework is made by attaching 1-in. by 1-in. by ⅛-in. (25-mm. by 25-mm. by 3-mm.) angle-iron pieces 13.5 in. (35 cm.) long to each wall of the compartment by means of long screws. Two parallel angle-iron pieces 2 ft. 9 in. (82 cm.) in length are attached to these uprights, one being hung from the top and the other being placed 6.5 in. (17 cm.) below. After the



RACK FOR POTENTIAL TRANSFORMERS

potential transformers are placed on the rack the terminal block is bolted to the top frames as shown.

The block holds the low-tension terminals in such a way that there is no danger of accidental contact with the high-tension leads below.

INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

TRANSFORMER FOR TESTING FIELD COILS OF MOTORS

How Defects in These Coils Can Be Quickly Determined, Together with Details of the Testing Device

For use in the repair shop of the Augusta-Aiken Railway & Electric Corporation, Augusta, Ga., the special transformer shown in Fig. 1 has been devised by the writer to test the field coils of motors. This device consists essentially of a rectangular core of laminated iron with one side removed, as shown in Fig. 1. On one end of this rectangular iron core a coil of 100 turns of No. 6 wire is placed and connected to a 110-volt circuit with an ammeter in series. When a field coil is inserted over the other end of the iron core—that is, the one shown at the right in Fig. 1—and the top side lowered into contact with the ends of the laminated core, the device is essentially a transformer with the permanent coil the primary and the field coil the secondary. When the field coil is free from grounds or short circuits it will act as an open secondary on a transformer, and no current except the exciting current, which is small, will be indicated on the ammeter. If there is a ground or short circuit in the field coil, it will act as a short-circuited secondary of the

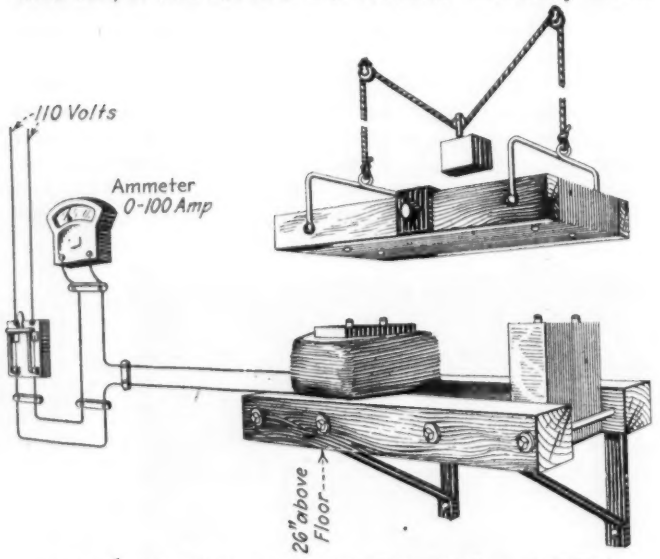


FIG. 1—METHOD OF MOUNTING SPECIAL TESTING TRANSFORMER

transformer and a current will flow in the primary or stationary coil of the device which will be indicated on the ammeter.

When applying the upper or movable side of the iron core it is essential that it be placed in immediate contact with the ends of iron core, and dowel pins are provided for this purpose. In case there is an air gap between the side of the iron core and the ends, caused by not being placed in immediate contact, the reduced reactance of the primary coil will be sufficient to allow a considerable current to flow and thus give a reading on the ammeter

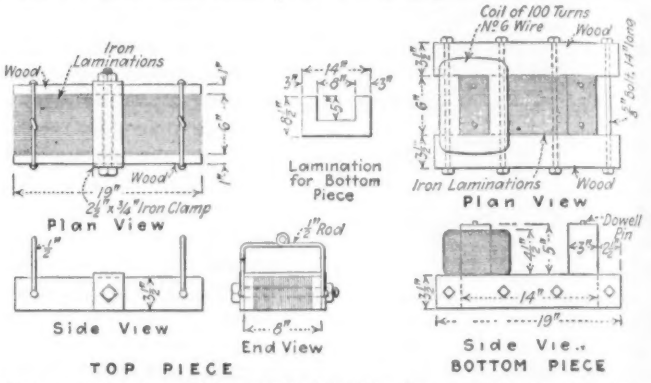


FIG. 2—DETAILS AND DIMENSIONS OF A SPECIAL FIELD-COIL-TESTING TRANSFORMER

which might be taken to indicate that the field coil being tested is short-circuited.

Details of construction of this special transformer and dimensions of the various parts are shown in Fig. 2.

Augusta, Ga. A. E. KIRKLY.

LOCATING TROUBLES IN MOTOR-DRIVEN FANS

Fan Propelled by Motor of Too Low Speed Fails to Perform Work—Brush Trouble Caused by Overspeeding Fan

For a given speed the output of a fan of certain diameter will depend partly on the shape and disposition of the blades, so it is practicable to have fans of different ratings that will fit the same shaft and the same housing. Moreover, the displacement of a fan will increase very rapidly with increase of speed. Practical illustrations of the conditions named are these:

A large direct-current motor-driven fan, used for exhausting the foul gases and smoke from a large forge room, failed to do its work satisfactorily. Tests indicated that the driving motor was regular in all respects, the voltage and speed being normal and the current well below the full-current rating. The last condition gave the fan inspector a clue. He knew that the motor, if properly applied, should be nearly fully loaded. On investigating he discovered that a wheel designated to operate at a higher speed than was being obtained had been supplied. Replacing of the fan wheel rectified the trouble.

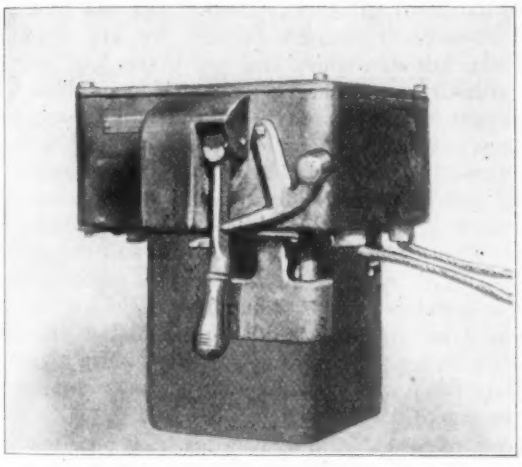
In another instance the brushes of the direct-current motor used for driving a fan sparked badly and disintegrated brushes faster than the operator was willing to pay for them. Investigation by a fan inspector disclosed that the fan was so belted to the motor as to give a fan

speed that was 20 per cent above normal. The increase was sufficient to overload the motor and the sparking was the result. As soon as the inspector had eliminated all sparking by partly closing the damper he knew that the cause of trobule was overload. He immediately suspected abnormal speed, and that proved to be the trouble.

SAFETY FEATURE ADDED TO MOTOR OIL SWITCH

Weighted Segment Slides Under Handle When the Switch Is Opened and Thus Prevents Its Accidental Closing

To prevent the accidental starting of motors in a Michigan mine cast-iron segments were attached to the casings of oil switches in the manner shown in the illustration. Each segment is weighted at the end furthest from the switch handle, so that when the switch is opened



CAST-IRON SEGMENT ON CASE OF OIL SWITCH PREVENTS ACCIDENTAL CLOSING

the segment will slide under the handle by gravity. When it is desired to close the switch the safety segment must be pulled to the right before the switch can be closed and the motor once more started.

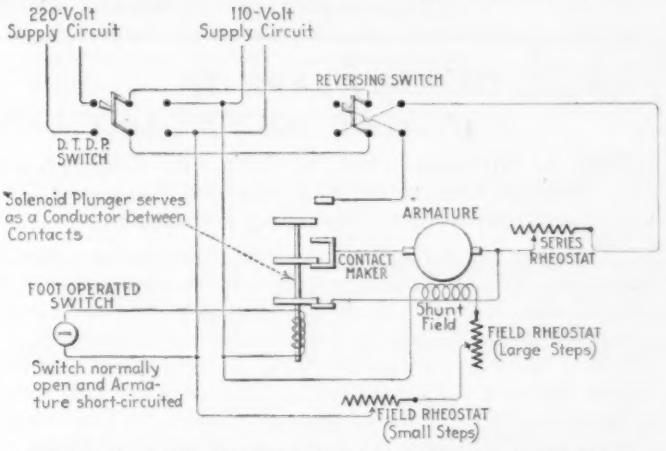
FRED E. THERREIN,
Chief Electrician. Calumet & Hecla Mining Company, Lake Linden, Mich.

VARYING LATHE SPEED FOR ARMATURE REPAIR WORK

Rheostats in Shunt Field and Double Source of Voltage Allow Speeds from Zero to 5000 R.P.M. Both Ways

Commutator turning and grinding and coil winding can all be accomplished on an ordinary motor-driven speed lathe in the shop of the Naumer Electric Company, New York City, by using field rheostats and energy supplied at two voltages to obtain the desired spindle speed. The greatest difference of speed is obtained with the use of the 110-volt and 220-volt circuits; rheostats in the separately excited shunt field afford the intermediate steps in speed.

For grinding a maximum speed of 500 r.p.m. is needed for good results, whereas for coil winding the speed must necessarily be low and in the opposite direction. This reversal is obtained by means of a switch which reverses the direction of current in the armature. For this work the armature must be started and stopped practically in-



PRESSING FOOT SWITCH OPENS SHORT-CIRCUIT ON ARMATURE, LETTING CURRENT FLOW TO MOTOR

stantaneously, so a foot-operated contactor is used. The normal position of this contactor is such as to short-circuit the armature. Pressing the foot switch energizes the contactor, thereby removing the short circuit, allowing energy to flow to the armature. When other operations are performed this control is not needed, and the contactor is mechanically locked in the open position.

REMOVING MOTOR FROM BASE ELIMINATES MOTOR TROUBLE

Liquor Handled by Centrifugal Pumps Became Stiff When Allowed to Cool So that the Motors Were Not Adequate

In a pulp and paper mill trouble was experienced some time ago where 7.5-hp., 550-volt motors were driving centrifugal pumps. The liquor handled by the pumps was of such a nature that when hot it flowed freely whereas when cool it became very stiff. The liquor "runners" were supposed to keep the liquor hot, but, owing to carelessness, it frequently was allowed to get cool. Since the pumps were belt-driven by motors mounted on the wall directly over the pumps, the belts would slip. When such a condition occurred the liquor runners would tighten the slipping belt by adjusting the motor on its base. This action overloaded the motor, which resulted in burning coils and sometimes brought about the failure of the motor.

To prevent the operators from trying to remedy the results of their own bad work in this manner wooden platforms were supported on angle-iron wall brackets and the motors mounted solidly thereon. This made it impossible to tighten a belt without cutting and re-lacing it. Since this change there has been no motor trouble because the liquor "runners" realize that the liquor must be kept hot.

W. B. SMITH,
Aroostook Pulp and Paper Mill.
Van Buren, Me.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods for Increasing the Use of Electric Light, Power and Heat

SMALL DEPOSIT SAFE ON SALE OF SOCKET DEVICES

John F. Gilchrist Tells N. E. L. A. Commercial Section Committee of Successful Extended Payment Merchandising Experiment

"We are calculating on the psychological effect created by asking for only a small first payment in our merchandise sales," said John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, to a Commercial Section committee of the National Electric Light Association recently. "In the early days of electrical merchandising on the deferred-payment plan it was customary to ask for 20 per cent or 30 per cent of the purchase price with the order. Then the first payments were gradually reduced until they equaled the subsequent payments, and now the initial payment is in many instances the smallest payment."

Mr. Gilchrist mentioned an experiment which was tried for one week. The company advertised that it would accept $1 down on anything in the Electric Shop. Some thought that this would lead people to order vacuum cleaners or washing machines for the purpose of cleaning house or washing exceptionally large lots of clothes and that they would then return the machines.

"A careful check was kept on the orders sold on a basis nearly as low as this in a former campaign," said Mr. Gilchrist, "and while the plan appreciably increased the business, it did not apparently increase the percentage of machines returned. An analysis also shows that the experiment actually created new business."

POOR LOAD FACTOR IS SOMETIMES DESIRABLE

May Go Too Far in Attracting Customers of Good Load Factor—Individual Consumers of Poor Load Pay High Rates

BY "KASSANDRA"

We have so often heard of the advantage and importance of good load factor that it is time the defendant, Mr. Poor Load Factor, should be given his day in court. In the first case poor load factors are a sign of advancing civilization. Our ancestors had one suit of clothes which they wore until it had to be thrown away. The load factor of the suit of clothes was 100 per cent when they slept in it. The load factor fell off to something like 60 per cent when they gave up sleeping in their clothing, while to-day the load factor of our best evening suits is under 1 per cent.

The load factor of our houses was much higher before the days of summer vacations. In the early days our cotton mills were run day and night on a much better load factor than at present, and though the present load factors of forty-four and fifty-four hours a week are in part due to other reasons, yet no one doubts that the present conditions are on the whole much more satisfactory than the conditions of former days.

In the central-station business the call for a good load factor is because we happen to sell our product and compute our costs on a special unit of kilowatt-hours. Suppose instead that we sold all our service at so much per lamp or per horsepower. It is perfectly clear that with this unit we should be hunting for the poor-load-factor customer.

The moral of all this is clear. We are looking for good-load-factor customers because we are thinking in prices per kilowatt-hour, and we make low prices per kilowatt-hour to attract customers of good load factor. The danger is that we may go too far. For instance, we have been tempted to make low prices for long-hour cooking devices. Now, it takes say 1 kw. three hours to do a piece of cooking which could be done by 2½ kw. in one hour, since in the former case the loss by radiation is greater. One operation takes 3 kw-hr. and the other 2½ kw.-hr. With enough customers and enough diversity factor, it is cheaper for us to supply the 2½ kw.-hr. rather than the 3 kw.-hr., and we can get a higher price for it, not only a higher price per kilowatt-hour but a higher price in dollars for fewer kilowatt-hours, because the customer is better served.

Therefore we should encourage the poor-load-factor business because in this case at least we not only make more profit for ourselves but also give our customers more value.

In the same way, an all-the-year-round hotel can put in a plant and operate at low cost per kilowatt-hour, while two hotels, one summer and one winter, would need two plants if they made their own "juice" and therefore are willing and glad to pay us more money for our service at an added expense to us for distribution lines only.

Again, 100 elevators, each of individual poor load factor but paying 8 cents a kilowatt-hour, are much more profitable than selling the same number of kilowatt-hours to fans or pumps that run with a high load factor but to which we would make a lower price.

Of course, we like a high load factor on the generating station, in fact on any part of the plant or investment; but, provided we can get enough diversity factor, we want individual customers of poor load factor who will pay high rates rather than individual customers of such good load factor that we have to make them low rates in order to get their business.

Therefore we should devote our efforts to finding and developing poor-load-factor business at profitable rates. In developing the poor-load-factor business and attracting it to our lines by good service we are merely carrying on the movement which has resulted in nearly everything we have being used at poorer load factors than in days when we were not so civilized as we are now.

GROWTH OF CENTRAL-STATION SERVICE IN NEW YORK CITY—II

Results of Tests in Representative Buildings to Determine Relative Costs of Central and Isolated-Plant Supply

BY W. H. WHITTON
New York Edison Company

[The first part of this article, describing cases I, II and III, was published in the ELECTRICAL WORLD for Nov. 29-Dec. 6, page 1018.]

Case IV.—Case IV is an office and loft building of eighteen stories, having a volume of 7,290,000 cu. ft. The number of elevators totals eighteen, all electric, and there is an electrical installation of about 14,000 lamps and 900 hp. The plant consisted of two 250-kw. generators, directly connected to two 350-hp. Hamilton Corliss engines, and one 100 -kw. generator directly connected to a 200-hp. Hamilton Corliss engine. Two balancer sets were used with the plant in operation. Edison service was used to a limited extent for auxiliary purposes. The boiler plant consists of two 250-hp. and one 100-hp. water-tube boiler now used for heating purposes and for operating seven steam pumps. The remaining auxiliaries are all motor-driven.

The comparative operating costs are:

Cost with plant:	
Coal, 4870 tons	$36,525
Labor, twelve men twelve months and two men four mo.	14,196
Ash removal	820
Boiler water	600
Supplies	1,250
Repairs	3,020
	$56.411
Edison service	2,880
Total	$59,291
Cost with Edison service:	
Coal, 2064 tons	$15,480
Labor, six men twelve months and seven men six mo.	10,110
Ash removal	350
Boiler water	300
Supplies	500
Repairs	1,200
	$27,940
Edison service	19,875
Total	$47,815
Saving:	
Coal, 2806 tons	$21,045
Labor, three men twelve months and one man two mo.	4,086
Ash removal	470
Boiler water	300
Supplies	750
Repairs	1,820
	$28,471
Edison service	*16,995
Total	$11,476

The Edison service amounts to a consumption of 630,000 kw.-hr. The fuel saving is about 58 per cent, or somewhat less relatively than in case I, where the conditions are in some respects the same. Both plants were efficiently operated, the difference in coal reduction probably being due to the greater relative use of energy in case I.

Case V.—Case V is an office building twelve stories in height, containing 462,000 cu. ft., thus being considerably smaller than any of the foregoing. It receives light on two sides, from the street front and from a court in the rear. The installation amounts to about 600 laimps and 75 hp., and there are two electric elevators. The plant consisted of two 50-kw. generators directly connected to 75-hp. simple engines. With the plant running an auxiliary connection to the Edison system was maintained for night, holiday and Sunday service, the cost in the last year of the plant's operation being $1,077.

Although there are boilers in the building, they have not been used for some time, steam being purchased. The pumps are all steam-driven.

The comparative costs are as follows:

Cost with plant:	
Steam, 8,182,000 cals	$7,146
Supplies	239
Repairs	250
Labor, two men	2,640
	$10,275
Edison service	1,077
Total	$11,352
Cost with Edison service:	
Steam, 3,700,000 cals	$3,704
Supplies	202
Repairs	170
Labor, two men	2,640
	$6,716
Edison service	3,347
Total	$10,063
Saving:	
Steam	$3,441
Supplies	37
Repairs	80
	$3,559
Edison service	*2,270
Total	$1,289

The electrical consumption amounts to 66,800 kw.-hr. annually.

It is interesting to note that the engineering force remained unchanged after the adoption of central-station service and that the entire savings were on other items of cost. On recommendation of the Edison engineers the pumping outfit is being electrified, and with this improvement further economies are expected.

Case VI.—Case VI is a comparatively small building occupied for printing purposes. It is five stories in height, has a volume of 224,960 cu. ft., and differs from the other cases in that the former power was mechanical and not electrical, a vertical shaft, running up through the building, operating a system of shafting and belting. The installation amounts to about 200 lamps and 50 hp., this including one electric elevator, which was formerly belt-operated.

The plant equipment before central-station service was installed consisted of one 150-hp. horizontal tubular boiler, now operated at low pressure for heating, and one 120-hp. Watts-Campbell simple slow-speed Corliss engine, which, in addition to the power equipment, also operated a 10-kw. belted generator for lighting purposes. There was one steam pump used for both boiler feed and house water.

The plant operated from 8 a. m. to 5:30 p. m. daily with a half-hour shutdown at noon; after 5:30 p. m. lighting service was supplied by Edison breakdown service.

The comparative report follows:

Cost with plant:	
Coal, 390 tons	$3,120
Labor, two men	1,924
Ash removal	192
Boiler water	40
Supplies and repairs	644
	$5,920
Edison service	126
Total	$6,046

* Added cost of Edison service deducted from savings to get net savings.

Cost with Edison service:	
Coal, 70 tons	$560
Labor, one man	440
Supplies and repairs	150
	$1,150
Edison service	2,064
Total	$3,214
Saving:	
Coal, 320 tons	$2,560
Labor, one man	1,484
Ash removal	192
Boiler water	40
Supplies and repairs	494
	$4,770
Edison service	*1,938
Total	$2,832

The consumption of energy last year was 36,371 kw.-hr. The saving, $2,832 yearly, is 47 per cent of the total cost of running the plant, a remarkable showing, especially when it is remembered that a great improvement in the operating efficiency of the printing equipment accompanies the change from the antiquated to the modern method, and that the gain is therefore twofold.

The results of these tests may be taken as fairly representative, the buildings selected including both large and small structures of varying types and ages. There are two office buildings, one hotel, one sales and showroom building, one building used largely for printing, with office and loft space rented out, and one smaller print shop.

It may well be inferred from the figures that only in exceptional circumstances will building owners feel justified in making investments for new generating equipment where reliable central-station service is available. It must be observed that in the comparative tabulation no provision is made for interest or depreciation on the investment represented by the plant machinery, and that in any new enterprise these items are the first to be considered.

For instance, were the owners of the building described as case I (reported in the issue of Nov. 29-Dec. 6, page 1018) to put up its counterpart now, they would, as part of the estimated cost of running a plant, include an item of from 12 to 15 per cent on the cost of installing the generating equipment. This would add from $15,000 to $18,000 yearly to the cost of the plant and increase the saving with central-station service to a yearly sum well over $20,000. It can readily be surmised what the owner would do.

HIGHER MINIMUM RATES FOR RESIDENTIAL LIGHTING

Average Cost per Customer in Small Towns Served by Transmission Lines Is 92 Cents with Important Items Omitted

Data on customer costs in towns served by transmission lines were compiled by J. W. Robb, vice-president and treasurer of the Wabash Valley Electric Company, Clinton, Ind., for presentation before the recent meeting of the Indiana Electric Light Association. Mr. Robb figured the cost of handling this business in towns where the company had from 800 to 2000 meters and in towns where the business runs from 90 meters to 600 meters. He found that the cost did not vary a great deal as between the larger group and the smaller group, the only difference being that in the larger towns the central stations secured a little better average kilowatt-hour consumption per consumer than they did in the small towns.

From seven towns served with energy supplied over transmission lines Mr. Robb compiled these averages:

	Average Cost per Consumer per Month, Cents
Reading meters	6 to 7
Billing and entering	3 to 5
Collection expense	7 to 10
Average cost of the three items	19
Interest and depreciation on plant	48
Interest and depreciation on line and transformer costs to the consumer's meter	25
Average of all above items	92

These costs do not include trouble service or other petty services and do not include anything for the electrical energy used. On this basis Mr. Robb declared his belief that most of the small plants of Indiana which serve these smaller towns over high-tension lines at minimum rates, varying from 75 cents per month to $1 per month, are not receiving high enough minimum charge.

"It may be true, of course," Mr. Robb stated, "that the large consumer and the small consumer are served over the same transmission line, but even if the large consumer is given credit for having used 30 per cent of the investment and for absorbing 30 per cent of the expense of conducting the business, there is still a fixed charge against each consumer of around 62 cents before the central-station company gets anything for the electric service which it renders the small consumer.

"Public opinion and state public utilities commissions are inclined to favor the small consumer, and I am surely one of those who believe that the small consumer's interest should be considered and that he should have every opportunity to get all the conveniences of light and power that can be given him; but I am also inclined to think that he does not appreciate the fact that every company is compelled to stand ready to furnish him service at all hours of the day and night and to keep his service as near constant as possible. My own company, as well as a number of companies over the state, are to-day providing service for the small towns and communities that could not be had except through high-tension lines connecting up with large station equipment. In fact, our company is giving twenty-four-hour service to towns which have from 100 meters to 400 meters and which if they depended upon individual installations in their separate towns could not possibly have to exceed six-hour to twelve-hour service during each twenty-four hours. Even this service they would have at an expensive rate. I think that the time has come when the people should be shown that they are getting all of the conveniences of the large cities through these high-tension connections."

Data on Appliance Sales

During the last four years the Commonwealth Edison Company has sold the equivalent of 80,000 kw. of electrical appliances. The company figures that this is worth in earning capacity $10 per kilowatt, hence its annual revenue from appliances sold during the last four years is $800,000 per year. During the year 1919 the company will do a merchandising business of $2,500,000, as against a business of $1,000,000 for 1918. This increase is due to the tremendous purchasing power of the people and to the shortage in domestic help.

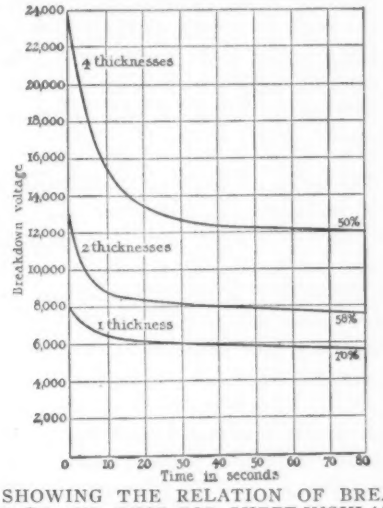
* Added cost of Edison service deducted from savings to get net savings.

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Large Power Transformers.—A. G. ELLIS and J. L. THOMPSON.—The second installment of this article is devoted to a comparison between the core and shell types of transformers and the protection against mechanical damage on short circuit. Some interesting curves are



CURVES SHOWING THE RELATION OF BREAK-DOWN VOLTAGE AND TIME FOR SHEET-INSULATING MATERIALS.

given on the properties of sheet insulation in various thicknesses. This is of importance both in the protection of coils of electrical machinery and in the insulation of underground cables.—London *Electrician,* Sept. 12, 1919.

Heavy-Duty Open-Type Three-Phase Motor.—ERNST DORFEL.—In this article the author shows, as the result of factory experience, that the open three-phase motor without short-circuiting device can be recommended for heavy-duty drives owing to its low cost of installation and maintenance and the small amount of attention it requires. He then goes on to show that expensive and complicated casings can be dispensed with where attention is paid to certain points of design, such as a sufficiently wide air gap. Finally, a few designs of brush holders of the frictionless type which have proved successful in heavy work are shown.—*Technical Review,* Oct. 2. (Abstracted from *Zeits. d. Ver. deutsch. Ingen.,* Aug. 9, 1919.)

Traction

The Stevens Petrol-Electric Vehicle.—The vehicle here described is the 3-ton War Office lorry. The electric generator is adapted to be used when required for providing a supply of electricity for searchlamps, arc welding, electric lighting, heating and battery charging. It can give a continuous output of 300-230 amp. at voltages of 80-110 respectively, and the characteristic of the machine can be adjusted so that it will under-compound, level-compound or over-compound. It can also be used as a shunt machine for battery charging. It is the four-pole interpolar type, connected through a flexible coupling to the petrol engine. The high-resistance shunt winding, in series with a multiple-contact resistor, is connected directly across the brushes of the generator for lighting and across the brushes of the motor for driving, the change-over being effected by a switch.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Elec. Rev.,* May 16, 1919.)

A System of Energy Recuperation for Direct-Current Traction.—G. SOMAINI.—Series-wound direct-current motors do not easily allow of the recuperation of energy when the train stops or when it is going down a hill. For this reason recuperation is not utilized to-day. The author's system utilizes motors the rotors of which are placed in shunt to an apparatus called by the author a "dynamotor," which is essentially a dynamo, of which the rotor is provided with two separate windings and commutators, these windings being conveniently connected in series and in shunt to the main. One of the windings is capable of a current three times larger than the other and, vice versa, the latter can stand a pressure three times larger than the former. The two windings are contained in the same slots of the rotor. The "dynamotor" consequently divides the pressure V of the main in two parts: $V/4$ and $3V/4$. The main motors are fed either at V or at $3V/4$ or at $V/4$, and as they are able to be coupled either in series or in parallel, each of them can then be fed at the following pressures: $V/8$, $2V/8$, $3V/8$, $4V/8$, $6V/8$, $8V/8$. The ampere turns of the two rotor windings of the "dynamotor" being practically equal and opposite, no appreciable magnetic reactions take place, so that even with the position of the brushes unchanged no sparking is produced. When the motors become generators no difference in the conditions of working of the "dynamotor" is produced. The exciting current for the main motors is derived at the "dynamotor" at the pressure $V/4$ through the rotor of a booster and two field resistances. The inductor windings of the booster are fed by rotor currents of the main motors, and the rotor of the booster is connected to the "dynamotor" so as to increase the exciting current of the main motors when starting and to diminish it when stopping. Supplementary resistances allow of obtaining three more speeds of the main motors, if required; altogether, nine speeds can be obtained. Experiments with the new system were made upon a tramway at Bologna, but the outbreak of the war prevented the author from continuing them. Further experiments are now being made, and the author will later on give information regarding these. Among the results already obtained, an energy economy of 25 to 30 per cent can be stated as being realized. A complete diagram of the connections and many details of construction are given.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Elettrotecnica,* May 25, 1919.)

Installations, Systems and Appliances

Modern Steel Making by Electricity.—Harry Etchells.—In this article the features of the Greaves-Etchells furnace are set forth, together with a general study of furnace operation, to show what difficulties the designers had to overcome in developing the Greaves-Etchells system.—*Journal of Electricity,* Oct. 1, 1919.

New Electric Generating Station at Denver.—H. H. Kerr and T. O. Kennedy.—The Lacombe plant of the Denver Gas & Electric Light Company has recently been completed and contains a 12,500-kw. turbo-alternator. The boiler-room equipment, ventilation arrangements, pumping units, coal handling and storing provisions and the turbo-generator units are briefly described.—*Journal of Electricity,* Oct. 1, 1919.

The Manufacture of Haematite Pig Iron and Steel in Electric Furnaces.—O. Hasler.—This paper discusses the question whether it is economical to smelt haematite pig iron and electric steel in electric smelting furnaces in Switzerland under the conditions at present existing and those likely to exist in the immediate future. The decision is given in the affirmative with a cost of energy up to 0.07 franc per kilowatt-hour. There is also taken into consideration the fact that with electric smelting it is not necessary to briquet the turnings, cuttings of sheet iron and other waste as is the case when smelted in cupolas fired with coke.—*Science Abstracts, Section B,* Sept. 30, 1919. (Abstracted from *Schweiz. Elektrot. Verein, Bull.* 10, May, 1919.)

Electroculture and Electromechanical Irrigation.—A. Pugliese.—The applications of electricity to the culture of the soil present the inconvenience of being unfavorable for the conditions of working and load of the central station furnishing the energy, as this is required in large quantity only for very limited periods of the year and the consumers are spread over a large area. For these reasons cost of installations, maintenance, etc., is very high. The author observes that the irrigation obtained by raising the water of rivers by electrical means in order to irrigate the fields could correct the aforesaid unfavorable conditions. These installations will be economically possible only when the fields to irrigate are large enough, sufficiently uniform, not too steep, and when a river is not too far from them and electrical energy is cheap.—*Science Abstracts, Section B,* Sept. 30, 1919. (Abstracted from *Elettrotecnica,* July 15, 1919.)

Electrochemistry and Batteries

Military Applications of Electroplating.—William Blum.—The writer outlines some of the problems which developed during the war in the question of applying finishing or protective metals. Much work was done in adapting the finish to the use or exposure of the particular metals under investigation, and it is now recognized that protective coatings should be properly selected.—*Proceedings A. E. S.,* Oct. 1, 1918.

Factors Governing the Structure of Electro-Deposited Metals.—William Blum.—The experiments here described were based largely upon Bancroft's axioms, which may be stated as follows: (1) Bad deposits are due to excessive admixture of some compound or to excessively large crystals. (2) Excessive admixture of any compound can be eliminated by changing the conditions so that the compound cannot precipitate. (3) Increasing the current density, increasing the potential difference at the cathode, or lowering the temperature, decreases the size of the crystals. (4) The crystal size is decreased when there are present at the cathode surface substances which are adsorbed by the deposited metal. (5) If a given solution will give a good deposit at any current density, it will give a good deposit at any higher current density provided the conditions at the cathode surface are kept constant. (6) "Treeing" is facilitated by a high potential drop through the solution and by conditions favorable to the formation of large crystals. The conclusions from these experiments are that for the common metals and over a considerable range of conditions the axioms of Bancroft are applicable. As opportunity offers it is hoped to conduct more exhaustive experiments in which the relative magnitude of the various effects for any given metal may be determined. From such studies it should be possible not only to define favorable operating conditions for plating baths now in commercial use, but also to suggest modifications which will permit more rapid and more satisfactory operation.—*Proceedings A. E. S.,* Sept. 23, 1919.

Telegraphy, Telephony and Signals

Wireless Telephony.—C. Gutton.—This paper gives a general outline of the development of wireless telephony by the French corps of military radio-telegraphy, with simple explanation of the general principles of operation.—*Science Abstracts, Section B,* July 31, 1919. (Abstracted from *Soc. Franc. Elect., Bull.* 9, May, 1919.)

The Uni-Control Receiver.—Roy E. Thompson.—The design and construction of a receiver, operating efficiently and selectively over a long range of wave lengths on any antenna of ordinary dimensions, and controlled by a single handle, are described in detail. The addition of a motor for driving the wave-changing adjustment continuously is shown. The possibilities of such a receiver for the solution of the interference problem are discussed.—*Proceedings Institute Radio Engineers,* October, 1919.

Short Wave Reception and Transmission on Ground Wires.—A. Hoyt Taylor.—After a historical review of the work of the United States Navy with underground and underwater receiving systems, the author gives data demonstrating the possibility of effective reception on such systems, particularly when using amplifiers. These systems are found to be directional toward waves traveling parallel to the length of the wire pair. This directional selectivity, which is marked, is applied in control stations for duplex working. For such underground systems an optimum wire length for reception is found to be roughly proportional to the wave length (for short waves) and independent of the direction of approach of the signal. The existence of this optimum length gives further utilizable selectivity. This length is independent of the nature of the surrounding medium and varies inversely as the capacity per unit length of the wire. The wire in question must be well insulated. Reception through violent storms and suppression of summer strays (particularly at short wave lengths) are accomplished. It is found that lowering such wire systems from above ground into wet soil or into water greatly increases the signal strength and diminishes strays. Transmission at short wave lengths over considerable distances, using such systems, has been possible with low-power sustained-wave transmitters.—*Proceedings Institute Radio Engineers,* August, 1919.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Coöperative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

ANEMOMETER, HOT-WIRE, THERMOCOUPLE TYPE.

In all hot-wire anemometers thus far used the instruments have been so designed as to measure the average velocity over the area of the pipe, or for a length of 10 cm. or greater at different points in the plane of cross-section. None of these types is suitable for the measurement of velocity in small tubes. It was for the purpose of making these latter measurements that the present instrument was constructed. It consists of a platinum heating wire 0.007 in. (1.8 mm.) in diameter and ½ in to 1 in. (1.25 to 2.5 cm.) long, stretched across a suitable framework, say of glass, and having a copper-constantan thermocouple made of 0.002-in. (0.5-mm.) wire attached at its midpoint. The instrument can be used satisfactorily by measuring the current that is necessary to maintain the temperature, as determined by the thermocouple, say 300 deg. C. above the temperature of the gas in which it is placed. This method facilitates the measurements greatly and avoids the possibility of accidentally burning out the wire.—T. S. Taylor, Westinghouse Research Laboratories, East Pittsburgh, Pa.

DEMAND MEASUREMENT.

A possible method is to use some form of kva.-hour meter with a demand attachment. Some of the manufacturers report investigation and some progress along the lines of a kva-hour meter.—N. E. L. A. Committee on Meters.

LIGHTNING ARRESTERS AT HIGH ALTITUDES.

Tests have been made on flashover distances, air breakdown, heat emissivity and other factors of importance in determining the performance of lightning arresters and other high-tension apparatus at high altitudes. These tests were made in closed containers, under varying air pressures and degrees of humidity.—L. W. Chubb, Pittsburgh, Pa.

TESTING VACUUM VALVES.

Means of testing "French" machine-made vacuum valves for radio-amplification purposes were devised to insure correct functioning of these valves in actual operation. Valves were also tested to destruction to determine the effect of excessive currents and voltages.—Robert W. A. Brewer.

TRANSFORMER, CURRENT.

A current transformer has been developed in which the ratio of the primary to the secondary current remains practically constant up to heavy overloads. The transformer is suitable for high-voltage lines and has been built for voltages up to 100,000. Its distinguishing feature is a circular primary coil of large diameter and small cross-section, linked with a comparatively small iron core. The primary coil is applied closely to the core. The separation between primary and secondary is sufficient to provide air insulation, thus obviating the necessity for oil or other special insulation. The primary coil is supported on conventional transmission-line insulators.—L. C. Nicholson, Buffalo, N. Y.

WELDING, ELECTRIC, OF NON-FERROUS METALS.

In spite of the considerable progress made in electric welding of iron and steel there is a great deal to be done yet, particularly on the welding of non-ferrous metals such as copper and brass. Attention may be called to spot welding of comparatively thin sheets of copper or brass as distinguished from the welding of large pieces or bars, as, for example, in the welding of the squirrel-cage winding of induction motors and similar applications. The writer would be glad to get in touch with others interested in this subject.—N. S. Diamant, Washburn and Walnut Streets, Lockport, N. Y.

Suggestions for Research

POWER FACTOR, EFFECT ON ELECTRICITY RATES.

While it is generally agreed that the power consumer ought to pay a fair amount for the lagging reactive kilovolt-amperes caused by his apparatus, there is no unanimity as to the basis for the extra charge. Moreover, there is no inexpensive instrument on the market to enable the operating company to take this charge into account in a proper way. The engineering problem in the case consists of two independent parts: First, it is necessary to investigate the general effect of reactive kva. upon the investment and upon the operating expenses, taking the load factor and the demand into account. This should lead to a proper basis for the extra charge for reactive kva. The second part of the problem is to devise an integrating instrument which would properly record this extra charge for a month, or which would modify the indications of the regular watt-hour meter and of the maximum-demand indicator so as to take the reactive kva. into consideration.—Editorial Suggestion.

POWER FACTOR, WITH INTERCONNECTED PLANTS.

We are operating two large power stations with small tie lines, and the fluctuating load on these tie lines results in changing the load center between the two points from time to time. This throws out the voltage regulation at the stations that takes care of our power-factor conditions. Of course, we are overcoming this to some extent by the use of condensers and synchronous apparatus, but still have many problems to solve in this connection. We also have a great deal of trouble from the relays that we have, on account of their failure properly to sectionalize the lines in trouble.—J. E. Thomas, West Penn Power Company, Pittsburgh, Pa.

RADIO AERIALS.

Measurement of capacity of small models of antennas to facilitate design of antennas; use of galvanized pipe as the conductor making up aërials, both antennas and coils; use of elevated large condenser in place of grounded antenna, carefully constructing the condenser so that there is no imperfect dielectric in its field; study of the inductance, capacity, resistance, dimensions and other properties of receiving and transmitting coil aërials; use of earth antennas and measurement of their constants and received currents; measurements of received current to verify and extend radio transmission formulas, determining variation with wave length, output of signal, etc.; study of variation of observed direction of radio waves with time of day; effects of local masses of metal in distorting observed directions on a direction finder; study of the combination of a receiving coil aërial with an antenna, with a view to determining the absolute direction of incoming wave.—J. H. Dellinger, Bureau of Standards, Washington, D. C.

TRANSMISSION LINES, TESTING OF.

A faulty high-tension transmission line should be preferably tested by means of a source of continuous voltage, rising gradually from zero to a value approximately equal to the amplitude of the operating voltage. With direct voltage there is no large charging circuit, and there is much less possibility of creating dangerous oscillations than with alternating voltage. A suitable source of direct voltage up to say 100,000 volts, even though with a very small amperage, would therefore be very valuable. It is possible that the Cottrell rectifier or the Delon apparatus ("Electrical World," Vol. 67, 1916, p. 665) might be adapated for the purpose; also a set of Thury machines, a hot-cathode rectifier, etc. The advantages of testing with high-tension direct current are such as to make the development of a suitable source well worth while.—W. P. Dobson, Hydro-Electric Power Commission, Toronto, Ontario.

WELDING, ELECTRIC AND GAS.

Even in the simplest applications of welding, investigations are needed, because of the great number of variables that affect the quality of a weld. But besides this there is a vast field for welding in the more important structural work where the strength of each member must be subject to calculation, such as building structures, railroad rolling stock, pressure vessels, boilers, bridges and ships. Therefore, in order to put welding on a more stable basis for all purposes, it is necessary first to ascertain the effect of these variables and to know definitely the conditions under which the best welds may be secured. This involves investigations, of which the following may be cited as illustrations: (1) In arc welding a determination of the best current to use with various sizes of electrode and different types of work. (2) A determination of the proper method of procedure in making up both gas and electric arc welds coupled with an adequate system of inspecting the work as it progresses. (3) In arc and gas welding, a determination of the proper angle of bevel and the space to be allowed between plates. (4) In arc and gas welding, an investigation of "electrode" wire and of "welding wire." (5) Further knowledge is desired as to the change in the characteristics of metal caused by welding, particularly as affecting its ductility and its action under repeated stresses. (6) In gas, spot or arc welding methods of assembling large structures to eliminate initial or locked-up stresses due to contraction on cooling. (7) Investigations to reduce the reactance in long-gap spot welders for thick plates such as would be used in shipbulding; also to determine the minimum safe distance between the welding spot and the spot carrying the return current. (8) Relative value of various forms of joints. (9) Methods of inspecting and testing the completed work.—From a preliminary announcement of American Welding Society.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

This issue of the ELECTRICAL WORLD *is the eighth that has been published at Buffalo, N. Y., owing to the troubles in the printing trades at New York City, now over, as announced previously. Publication in New York will be resumed with the first issue of the new year.*

Before adjourning for the holidays the United States Senate agreed to give the water-power development bill of the House of Representatives the right of way when Congress reconvenes on Jan. 5.

An industrial safety conference was held at the Bureau of Standards, Washington, on Dec. 8. Dr. Edward B. Rosa presided in the absence of Dr. S. W. Stratton. He announced the appointment of a general advisory committee on industrial safety codes to assist the bureau in deciding upon policies and procedure in its work on safety codes. A resolution was passed providing that the American Engineering Standards Committee be asked to request the International Association of Industrial Accident Boards and Commissions, the Bureau of Standards and the National Safety Council to organize a joint committee on safety codes.

"Steam Versus Electric Drive for Steel Mills" was a topic that elicited considerable valuable discussion at the Pittsburgh meeting of the Association of Iron and Steel Engineers, Saturday evening, Dec. 20. G. E. Stoltz emphasized some of the advantages of electric drive and cited some figures on unit cost of operation and output of motor-driven mills. Most interesting of all, however, were the data contributed directly by steel-mill representatives, notably Mr. Sieberts, Bethlehem Steel Company, and E. S. Jefferies, Steel Company of Canada. Both showed that electrically driven mills can be operated at about half the unit cost of steam-driven mills. K. A. Pauly also presented some interesting performance data and outlined the status of electric drive in steel mills to-day.

Visitors to Europe who have returned home recently are Dr. C. O. Mailloux, who was elected president of the International Electrotechnical Commission for the next period of two years; Gerard Swope, president of the International General Electric Company, Ltd., and Walter Cary, vice-president of the Westinghouse Electric & Manufacturing Company.

Continued fair weather has allowed the streams throughout the Southeastern section of the United States to return to their normal heights.

Summarized News

Principal Happenings Up to Closing of Forms for This Issue—Printed Dec. 26

The Western Association of Electrical Inspectors has adopted a comprehensive program for its three-day convention at St. Louis on Jan. 27, 28 and 29, 1920.

An informal meeting and dinner of load dispatchers and assistant system operators representing nine of the leading New England central-station and transmission companies was held at the Engineers' Club, Boston, recently, at the suggestion of R. S. Hale, superintendent of the special research department, Edison Electric Illuminating Company of Boston.

A Vacuum Cleaner Manufacturers' Association has been formed in Cleveland, all the manufacturers in the United States being represented at the organization meeting. Charles S. Beardsley of Canton, Ohio, was elected chairman of the association.

At a meeting of the overhead systems committee of the National Electric Light Association in Denver responses to questionnaires issued by sub-committees were considered. The greatest interest is being displayed in the question of insulator maintenance.

Heavy sales have characterized the whole electrical trade manufacturing, distributing and retailing. Christmas sales have been particularly large, and stocks of virtually all electrical material which can be used as gifts are extremely low. Late comers have had to take the left-overs of stocks. In all classes of goods large orders are being refused because of inability to supply the order in full.

Prices have advanced on certain tapes and webbing, on an average, up to twenty-six points. Conduletes have advanced 20 per cent. The South and West report sewing-machine motors up 10 to 15 per cent, and the West announces an advance of 15 per cent on fiber sheet and tube. The South shows white cedar poles up 25 per cent. In the West good inquiries are coming in for motors for the canning and kindred industries. Flooded districts in the South require the larger sizes of rubber-covered wire for replacements. In the West there is an increasing demand for signs and lighting fixtures. Stocks of these are low. Premiums are being offered on shipments of telephone wire in the East, showing the production conditions of the wire mills.

Great interest was shown in the analysis of the present status of automatic telephone equipment made by Arthur Bessey Smith, electrical engineer of the Automatic Electric Company, before the 356th meeting of the American Institute of Electrical Engineers, held in New York on Dec. 12. Progress in the use of searchlamps in the navy and army was described by former Lieut. Ralph Kelly, U. S. N., and Capt. Chester Lichtenberg, U. S. A.

General information cards have been issued by the Underwriters' Laboratories at Chicago on four renewable fuses and on one fuse formerly in the standard class. This grants the Underwriters' approval and label service to the "Union" fuses of the Chicago Fuse Manufacturing Company, the "Economy" fuses of the Economy Fuse Manufacturing Company, the "National" fuses of the Federal Electric Company and the "Trico" fuses of the Trico Fuse Manufacturing Company, which have been distributed through the M. B. Austin Company, and reclassifies the "Atlas Four-in-One" fuse made by the Multiple Electric Products Company as an approved renewable fuse. The sizes which have been approved follow: "Union," 0 amp. to 600 amp. in 250-volt ratings, none in 600-volt ratings; "Economy," full line, including 0 amp. to 600 amp. in 250-volt ratings and 0 amp. to 600 amp. in 600-volt ratings; "National," 0 amp. to 400 amp. in 250-volt ratings and 0 amp. to 100 amp. in 600-volt ratings; "Atlas," 0 amp. to 200 amp. in 250-volt ratings and 0 amp. to 30 amp. in 600-volt ratings; "Trico," full line, including 0 amp. to 600 amp. in 250-volt ratings and 0 amp. to 600 amp. in 600-volt ratings. This announcement follows closely upon the news that a section has been added to the Underwriters' Laboratories code to provide a standard for renewable fuses. This code of the Underwriters' Laboratories is written for electrical appliances and includes a section for each device. In the recent revision the section which it had contained on standard inclosed fuses was revised and the new section on renewable fuses was added. It is under this section that renewable fuses have become approved. This section on renewable fuses was worked out by the staff of the Underwriters' Laboratories at the request of the Electrical Council, with the co-operation of the Fuse Section of the Associated Maufacturers of Electrical Supplies, and was recommended to the Electrical Council for adoption by the fuse industries conference. As to the test requirements, apparatus and methods, the standards for renewable fuses closely parallel the procedure for standard cartridge inclosed fuses.

IMPORTANT N. E. L. A. MEETINGS ARE TO BE HELD IN JANUARY

Public Policy Committee and Executive Committee to Convene in New York—Mr. Britton and Mr. Ballard to Be Present

Announcement is made of two important meetings in connection with the enlarged activities of the National Electric Light Association, to be held in New York in January.

A meeting of the public policy committee will be held at the New York headquarters of the association on Jan. 29, 1920. John A. Britton, chairman of the committee, will travel from San Francisco to be present and full attendance of all of the other members is expected. Suggestions and advice will be received from the committee in regard to the future activities of the associations and the new program which is being arranged for the larger work which it is believed can be done.

The executive committee will meet in New York on Jan. 30, and President R. H. Ballard of Los Angeles will preside. The committee will act on the program for future activities and will try to settle definitely the matter of geographic sections. M. H. Aylesworth, executive assistant to the president, stated that the outlook for the country-wide development of geographic sections is very encouraging. "The plan," he said, "has received widespread favorable comment. Many state associations have evidenced a desire to co-operate in carrying out the general plan."

COAL STRIKE SETTLEMENT BRINGS RELIEF TO ALL

It Removes or at Least Reduces a Menace Which Seriously Threatened the Central-Station Industry—Question of Cost

Settlement of the coal strike by acceptance of President Wilson's plan by the bituminous miners removes, or at least reduces, a menace which seriously threatened the central electric station industry.

While the operators of central stations will follow with keen interest the results of the investigation of wages and costs by the proposed commission, they are naturally concerned over the prospect of higher expense for fuel which this presents. High fuel cost points to higher rates for electrical energy.

The immediate emergency, however, is one in which production of coal is the first requirement, and therefore the hope is that both operators and miners will aid in doing their utmost to stimulate output. A promise of this is seen in the announcement of the operators which said: "Realizing the imperative need of coal in large quantities, the operators stand ready now, as in the past, to bend all their energies toward a maximum production, beginning at once."

Reserve stocks have been drawn down by the interruption of mining operations, and the formal settlement of the strike does not carry assurance that these can be built up again under winter transportation conditions. Every effort, however, will be made by central stations not only to meet their day-to-day needs for fuel but also to store supplies for future requirements and emergencies.

The immediate menace removed by formal ending of the strike, the end of the new active period of the United States Fuel Administration and also the resignation of Dr. H. A. Garfield as Fuel Administrator mean that the question of supply becomes again a matter of local negotiation and effort for the central stations.

NEW SYSTEM OF PRACTICAL UNITS ADOPTED IN FRANCE

International Electrical Units Are Accepted Unchanged, but Mercury Thermometer Degree Is Rejected

In a recent proclamation President Poincaré has established a set of standards to be used in France as units for industrial and commercial purposes. The new system refers to the C. G. S. system, with its fundamental units; the length of the international meter prototype at the Pavillon de Breteuil, in Sèvres, the mass of the international kilogram prototype, also at Sèvres, and the 86,400th part of the average solar year. The international electrical units are accepted unchanged, but the new system offers several interesting novelties in other respects. The decimal degree is mentioned as the officially preferred unit for angular measure, the right angle being the unit, abbreviated *D*, and subdivided into 100 *grades* (*gr.*). The common circular degree is called *degré* (with the symbols *d.*, ° or *).

The system does away with the undesirable double use of the kilogram and the tonne as units for both mass and force by introducing a new unit for force, *sthène* (*st.*), one sthène being equal to 10^8 dynes, or the force that gives the mass 1 tonne an acceleration of 1 meter per second per second. The corresponding unit for pressure is *pièze* (*pz.*), or 1 sthène per square meter; the *hectopièze*, or 100 pièze, is equal to one *bar*, and one ten-thousandth of a pièze is a *barye*, or one dyne per square centimeter. The normal air pressure is 1.013 hectopièze.

The kilowatt is recommended as a unit for power, with the *cheval-vapeur* (0.735 kw.), and the *poncelet* (100 kgm. per second, or 0.98 kw.), as auxiliary transitory units.

The basis for temperature measurements is the gas thermometer, one *degrè centesimal* (1°) being defined as the change in temperature that will give, in a mass of a pure, perfect gas, under constant volume, a change in pressure equal to one hundredth of the total change between the freezing point and the boiling point of pure water. As the mercurial degree, so is the calory discarded, and instead the *thermie* (*th.*) is introduced. One thermie is the amount of heat required to give 1 centesimal degree rise in the temperature of a body with the mass 1 tonne, and of the same specific heat as pure water at 15 deg. and 1.013 hectopièze.

In these days, when many good reasons are offered pro and con for a universal adoption of the decimal system, it is proper that existing ten-power units should be discussed, revised and refined with the greatest thoroughness. In the past the French always have been considered the highest authority in regard to units and their definition, and other nations may well give the new French system the most serious consideration.

A complete account, in tabular form, of the new French system of units may be found in the *Revue Générale d'Electricité* of Sept. 6, 1919.

NEW 32,500-KVA. UNIT IS DEDICATED AT NIAGARA FALLS

Starting of First of Three New Generating Units of Niagara Falls Power Company Witnessed by Many Guests

At 2:30 p. m. Saturday, Dec. 20, J. F. Schoellkopf, chairman of the board of directors of the Niagara Falls (N. Y.) Power Company, threw the switch that formally placed in operation the first of three 32,500-kva. generators in the new addition to the company's No. 3 station, just below the International Bridge on the American bank of the Falls. This event was witnessed by about 500 men prominent in the industries of Niagara Falls and Buffalo and 350 employees of the company. It marked the addition of 112,500 hp. to the company's generating capacity, the increasing of the rating of station No. 3 from 130,000 hp. to 242,500 hp. and the swelling of the total rating of the six stations now in operation to just short of 500,000 hp.

Guests from Buffalo and the surrounding district were brought to Niagara Falls in special cars over the high-speed line, arriving at 1 o'clock at the plant, where a buffet luncheon was ready. At 2 p. m. they were ushered into a large auditorium which had been especially built for the occasion at the south end of the new generator room. This room, which comfortably seated the 500 guests, was provided with a speakers' platform, and at the rear near the roof there was a fireproof cage to house the moving-picture machine that, after the speaking, produced on a large screen a "movie" story of the construction of the new addition.

ADDRESSES AT DEDICATION

Promptly at 2 p. m. Paul A. Schoellkopf, president of the Niagara Falls Power Company, introduced George W. Whitehead, Mayor of Niagara Falls, who paid a handsome tribute to the Schoellkopf family and those allied with them in the development of Niagara power. The next speaker, A. Monro Grier, president of the Canadian Niagara Power Company, also added an eloquent tribute to the Schoellkopf vision and to that of William B. Rankin and Horace H. Day, who preceded Jacob F. Schoellkopf in attempts to develop power from the waters of the Niagara River as conducted through the first crude canal. He pointed out that not until that canal was purchased in 1877 by Jacob F. Schoellkopf and enlarged and improved at great cost did the work show indications of possible success. To-day the sons and grandsons of this pioneer of vision are executing his plans.

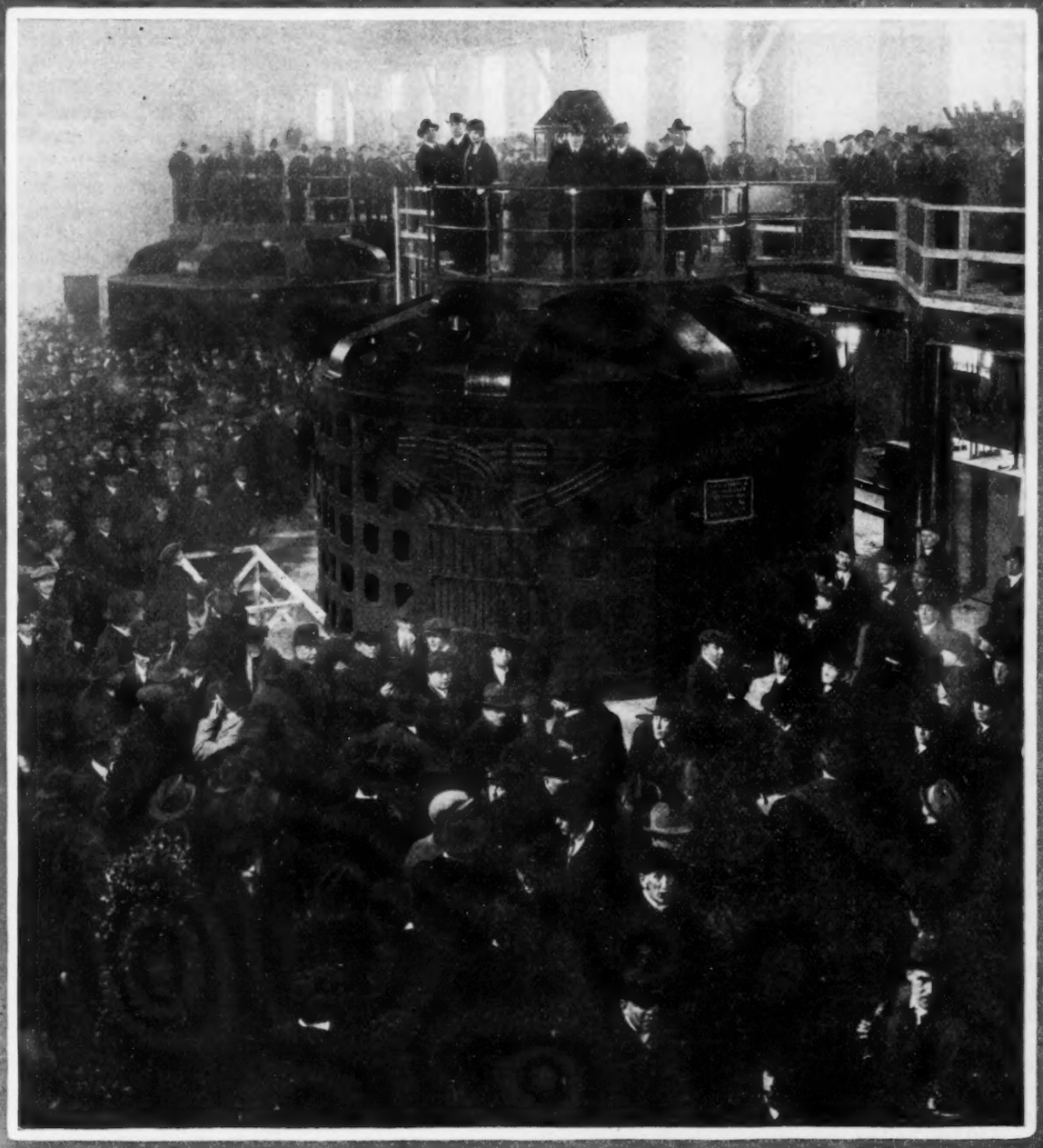
In responding to these two addresses for the company, Vice-president and General Counsel Morris Cohn, Jr., pointed out that the possibilities of the practical use of Niagara power are now obvious to every one. But for years the practical details were obvious to one man, and to him there is given the greatest of credit in the execution of all the engineering work. This man is John L. Harper, vice-president and chief engineer of the Niagara Falls Power Company. Mr. Cohn outlined in considerable detail the work that has been done by Mr. Harper to develop the power of Niagara Falls without destroying its scenic beauties. This work has plainly shown that much more water can be diverted from the Niagara River without reduction of the flow at the falls or injury to navigation. He estimated that 1,000,000 hp. can be produced at various points on the Niagara frontier. In this connection he pointed out the urgent need of power by the industries at the Falls, at Buffalo and nearby cities. He also paid tribute to the executives of the Buffalo General Electric Company, who, confronted by the shortage of power in that section, built its 90,000-kw. steam plant. This plant during the war, when the demand for power was at its highest, prevented nothing short of an industrial depression. With the added capacity of the new units, power is being generated at Niagara, Mr. Cohn stated, cheaper than the Ontario Hydro-Electric Commission is delivering it, tax free, to the city of Toronto.

NEW ADDITION TO PLANT COST $8,000,000

A central figure of many groups of guests during the afternoon was John L. Harper, chief engineer of the company, receiving the congratulations of his friends, who know him to be the engineering genius associated for years with the late Arthur Schoellkopf and with J. F. Schoellkopf in the working out of the great task of developing one of the gigantic water powers of the world. In commenting on the new addition to the station formally dedicated, Mr. Harper stated that the power company had expended about $8,000,000 in carrying into effect the river channel deepening, hydraulic canal deepening, lower basin enlargement, construction of the new forebay, the three large penstocks driven through solid rock from top to bottom of the high embankment, and the construction and equipment of the power-house addition. He said that an efficiency of about 22 hp. per cubic foot of diversion is obtained by the large new units and that 93 per cent efficiency of the water will be secured, as against only 10 per cent obtainable in power developed by coal combustion. This new addition therefore represents a saving of 900,000 tons of coal per year.

The plans of the Niagara Falls Power Company propose further construction to the extent of probably six more units of 32,500 kva. rating. This is intended for the purpose of redeveloping the water now diverted by the plant of the company on the upper Niagara River. This work will not, however, be started until after the water-power bill now before Congress becomes a law and the commission authorized thereunder has sanctioned it.

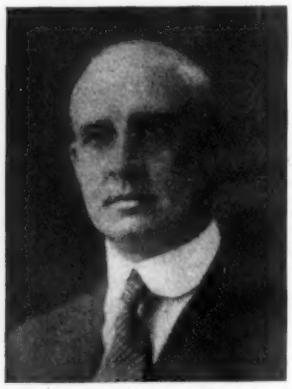
The new unit placed in operation Dec. 20 consists of an Allis-Chalmers 25-cycle, three-phase, 12,000-volt generator, rated at 32,500 kva., driven at 150 r. p. m. by a single-runner, inward-discharge Allis-Chalmers water turbine operating under an effective head of 215 ft. The shaft of the waterwheel directly connected to the generator measures 27 in. in diameter. The entire unit from the tailrace to the top of the Kingsbury bearing in the generator housing stands 67 ft. high. The waterwheel is connected to a penstock 15 ft. 6 in. in diameter and 350 ft. long. This penstock opens into a forebay 78 ft. wide by 160 ft. long and 28 ft. deep, fed by a hydraulic canal with its intake about a half mile above the American Falls. Two similar penstocks are connected to this forebay and to two similar units in the same addition that will also be started in the early future. The two additional units are of the same general design as the one just placed in operation, one consisting of a General Electric generator driven by an I. P. Morris waterwheel and the other of a Westinghouse generator also driven by an I. P. Morris waterwheel.



Starting First of Three Huge Generators at Niagara Falls

The unit in the foreground, which was officially started Dec. 20, is one of three in a new addition to station No. 3 of the Niagara Falls Power Company. Each consists of a 25-cycle, three-phase, 12,000-volt, 32,500-kva. generator driven at 150 r. p. m. by a single-runner waterwheel operating under an effective head of 225 ft. These units bring the rating of station No. 3 up to 242,500 hp. The construction and equipment of the new addition cost $8,000,000.

Public Utility Men in Public Affairs



JAMES E. DAVIDSON

The vice-president and general manager of the Nebraska Power Company has just succeeded in raising $1,000,000 in Omaha for the Ak-Sar-Ben exposition, a local recreation plant and playground designed to bring 300,000 visitors to Omaha annually.

COMPREHENSIVE FUEL STUDY FOR OMAHA POWER PLANT

Investigation Covering Several Months Is Made to Find Most Economical Steam Coal and Best Method and Equipment for Burning It

Because of a wide variety of fuels available on a closely competitive basis, the Nebraska Power Company of Omaha has found it advisable to make a thorough study of steam coals. The coal fields from which the company draws its supply are Colorado, Wyoming, southeastern Kansas, northern Missouri, Iowa, southern and central Illinois and Indiana. The coals available range from 8000 B.t.u. to 12,000 B.t.u. (2000 calories to 3000 calories) per pound of coal as received, and from a sub-bituminous through a free-burning bituminous coal to a caking bituminous coal. The plant in which these coals are burned consists at present of eight 500-hp. Babcock & Wilcox boilers, seven 550-hp. Stirling boilers and two Aultman & Taylor 440-hp. boilers, all equipped with chain-grate stokers of Babcock & Wilcox and Green manufacture.

The procedure of the study was as follows: First, the engineers collected and checked the available information on the kinds of steam coal that could be obtained. They found that, while there is much information contained in government bulletins, etc., on coal in general, there is a scarcity of reliable information showing what average heat values may be expected from a year's deliveries of steam coal. Further data were secured along this line from the coal merchants and from manufacturing plants that bought steam coal and analyzed it for purposes of their own. An analysis of the answers to inquiries of this nature gave an approximation to the average values that might be expected from various districts. From this information it was possible to select certain fuels that apparently had the greatest possibilities of proving successful under conditions such as had to be met. About six coals were tested.

After this work had been completed furnace designs were changed to improve combustion conditions when burning the types of coals that were to be tested. These changes were made with the expectation that they might also increase boiler ratings and at the same time reduce furnace maintenance. While the test work was going on an investigation was also made as to what plan of boiler-room operation should be adopted to give the best results. For instance, trials were made to determine whether or not it would be better to bank certain fires and run the remaining boilers at high rating or to operate the entire bank at lower ratings. This necessitated boiler efficiency tests on each type of boiler with all fuels and a more intensive study later with the fuel that was selected.

The stoker situation was also investigated to determine what it was possible to do with the present equipment, after which a study was made to determine the best policy when increased rating is needed, with an idea of keeping down the investment cost without increasing the cost of operation.

NEW YORK SECTION OF THE A. I. E. E. IS FORMED

H. W. Buck Elected Chairman and H. A. Pratt Secretary-Treasurer—Section Necessitated by Rotation of National Meetings

On Dec. 10 a meeting was held in the Engineering Societies Building, New York City, and a local section of the American Institute of Electrical Engineers was organized. H. W. Buck was elected chairman and H. A. Pratt secretary-treasurer. Bylaws were adopted that embody the best points of the bylaws of the most active local sections. The scope, activity and periodicity of meetings will be determined by the executive committee, which will include the chairman and secretary-treasurer and W. S. Finlay, Jr., E. B. Craft and Farley Osgood.

This local section is considered a necessity because the rotation of national meetings has left and would leave New York without meetings many months. With the new arrangements meetings will be called so they will fill in the vacancies left by the holding of national meetings in other cities.

INDUCTIVE INTERFERENCE COMMITTEE MEETS IN DENVER

Second Meeting of N. E. L. A. Committee Again Emphasizes Need that Power Companies Shall Contribute Information

The second meeting of the inductive interference committee of the National Electric Light Association was held in Denver, Col., on Dec. 1, 2 and 3. The meeting was well attended by members from many parts of the country, with a liberal proportion of Western representatives.

Some of the sessions were devoted to a continuation of the attention given at the Chicago meeting in September to organization for the work in hand, including the establishment of a centralized agency to assist power companies to effective co-operative effort and a better understanding in meeting the difficult problems of the inductive inter-

ference situation. This is a situation continually increasing in proportion with the rapid multiplying of power and communication circuits.

Other sessions were devoted to sub-committee work in analyzing and compiling information pertinent to the situation and to consideration of requests from several localities for advice in meeting specific and active inductive interference problems.

The discussions lent renewed emphasis to the committee's realization of its need for thorough support from the power companies at this stage, in the contribution of information on their experience and methods of meeting problems of this kind.

The chairman of the committee is A. E. Silver, Electric Bond & Share Company, New York.

THREE-DAY MEETING OF ELECTRIC POWER CLUB

European Conditions and Work of International Electrotechnical Commission Outlined by President Burke—Chairmen Elected

Holding its first general meeting since the rearrangement of its organization, the Electric Power Club had a busy three-day session at the Homestead, Hot Springs, Va., on Dec. 11, 12 and 13. One of the unusual features of the meeting was a presentation of some of the conditions found in Europe by the president, James Burke, also president of the Burke Electric Company, who had just returned from a trip as one of the United States delegates to the meeting of the International Electrotechnical Commission in London. Mr. Burke received a hearty welcome from the members.

At the opening session Mr. Burke remarked that although the club has done an enormous amount of work in the past, it is little in comparison with what can be done in the future. This forecast was borne out by the reports of committees and sections, outlining progress and development policies, which are well in hand.

C. H. Roth, the secretary, reported on the increased efficiency in the transaction of business which has been secured under the policies adopted at the preceding meeting. He said that the club had been growing very much in members and influence and in recognition by outside individuals and other associations, and this justified the conclusion reached that a rearrangement of the organization was desirable.

Reviewing the history of this rearrangement, Mr. Roth said that the discussion of the subject by the board of governors for some time was crystallized in the plan presented by Clarence L. Collens, II, to the board. In modified form this was approved at the meeting in May 1919. It allowed the admission to membership of a number of electrical manufacturing interests not then identified with any association. The following sections were authorized: (1) Transformer Section; (2) Industrial Control Section; (3) Power Switchboard and Oil Circuit Breaker Section; (4) Mining and Industrial Locomotive Section; (5) Motor and Generator Section (not including turbo-driven apparatus); (6) Turbo-Driven Apparatus Section; (7) Storage-Battery Section; (8) Electric Welding Section; (9) Electric Furnace Section; (10) Portable Electric Tool Section; (11) Electric Measuring Instrument Section (not including integrating instruments but including instrument transformers).

Owing to the change in organization and the small representation of some sections at the general meeting in May, the board authorized a letter ballot for election of section chairmen, which resulted as follows: Section 1, M. O. Troy; Section 2, H. D. James; Section 3, J. W. Upp; Section 4, S. B. Belden; Section 5, C. L. Collens, II; Section 6, W. J. Friedlander; Section 11, M. C. Rypinski. The chairmen of the other sections have not yet been announced.

As soon as chairmen were elected for the various sections they were requested to call meetings of their sections for classifying rules in the handbook into adopted standards, recommended practices and suggested standards for future design. All of the rules have been classified except those coming under nomenclature, commercial, standardization, safety regulations, apparatus application and general engineering recommendations. As soon as these are completed a new edition of the handbook will be issued.

The invitation extended by the club at the last meeting to the Portable Tool Association to become members of the club was accepted, and thereby the following became members and now form the Portable Electric Tool Section:

Electro Magnetic Tool Company, Chicago; Hisey Wolf Machine Company, Cincinnati; Independent Pneumatic Tool Company, Chicago; Temco Electric Motor Company, Leipsic, Ohio; Black & Decker Manufacturing Company, Baltimore; Chicago Pneumatic Tool Company, Chicago; Cincinnati Electric Tool Company, Cincinnati; Niel & Smith Electric Tool Company, Cincinnati; United States Electrical Tool Company, Cincinnati; Van Dorn Electric Company, Cleveland.

REPORT ON EUROPEAN CONDITIONS

Mr. Burke's report on European conditions was divided into two parts. In his more formal discussion at one of the business sessions he told something of the work of the International Electrotechnical Commission. At the "get-together dinner" on Friday evening he related some of the more personal experiences and gave much general information on European conditions. He gave a complete outline of the organization of the international commission and told many interesting details of the methods of procedure. The United States delegates to the commission, appointed by the American Institute of Electrical Engineers, were Dr. C. O. Mailloux, who was named as president of the United States Commission, H. M. Hobart, H. E. Chubb and Mr. Burke. Dr. Mailloux was elected at London to be president of the international commission for the next period of two years. The 1920 meeting, as announced previously in the ELECTRICAL WORLD, will be held in the United States.

Mr. Burke said that the assignment of space to delegates at the London meeting was arranged carefully and appropriately to each country, and all of the proceedings were conducted with formality and dignity. After preparatory work on Monday morning there was never an occasion until adjournment when delegates were not attending some meeting or gathering connected with the work. Long hours were kept, and except for two evenings the meetings lasted every night until midnight. One of those two evenings was devoted to the dinner, at which A. J. Balfour

made the principal address. Another afternoon and evening were given to a visit to the National Physical Laboratory. The meeting ended Sunday night at midnight, the English members foregoing their usual week-end holidays in order to end the business in one week.

All of the proceedings were in both French and English, immediate translations being made as a speaker finished part of his remarks. Dr. C. O. Mailloux, president of the American National Committtee, won much praise and honor by his linguistic abilities. The excellent address by Mr. Balfour was one that was translated by Dr. Mailloux. In speaking of Mr. Balfour's address, Mr. Burke said that the scientific men were impressed by the fact that a great statesman should have so keen a grasp of the importance of standardization. He spoke of Mr. Balfour's warning not to overdo standardization, not to let it obscure the necessity for development, but also not to neglect it and not to overlook its great international importance.

Mr. Burke said, in explaining the worldwide scope of the commission, that it was remarkable to see how much standardization work is going on. He said that a dictionary will be issued giving nomenclature in all languages and that the choice of terms will be guided very largely by the possibilities of translation into foreign languages.

Symbols are being pushed forward for international expression, Mr. Burke added. Standard tables for aluminum will be prepared similar to those for copper. Italy has done a great deal of work on standard test pressures for insulators and is continuing it.

Mr. Burke also discussed with much interest and appreciation the comprehensive organization of the British Electrical and Allied Manufacturers' Association and a meeting with the motor and generator section of that body which he attended with Messrs. Hobart and Chubb. He praised highly the close organization of the British electrical industry.

In his account of his personal experiences Mr. Burke mentioned the desperate need of coal for heat and power, the closing of 3500 factories in Paris because the electric supply company was too short of coal to furnish power, and the restrictions providing that lights could be turned on two hours after dark and that all lighting must be turned out at midnight. Germany is using aluminum largely instead of copper in motors and has developed aluminum alloys of great strength for use instead of bronze. English factories are sold two years ahead, and the working classes are making high wages. Eventually England will take care of all of its requirements for motors except those of small size, which can be made cheaply here by mass production. English manufacturers and people are doing wonderful team work and are developing new methods such as that of utilizing separate factories to make a few sizes of motors instead of great varieties in each factory.

At one of the sessions of the Power Club Walter Gordon Merritt, counsel for the League for Industrial Rights, made an extended address.

A. H. Timmerman, as chairman of the committee on technical standardization, reported that the broadening activities of the Electric Power Club in new fields make it necessary to consider quite carefully the scope of standardization work in the new sections.

"As we add to the lines covered it becomes incumbent on us," he said, "not to encroach on the work of other national organizations. For example, the Society of Automotive Engineers has probably carried standardization far further than any other organization. Its work now covers the standardization of small gas-driven generators and storage batteries used for small farm-lighting plants. It has up for approval in January a complete list of small generators of various sizes. This work is being handled by its stationary engine committee. The same committee is handling, in combination with the automotive electrical equipment committee, the standardization of batteries used in connection with farm-lighting equipments.

"Another organization, the Automotive Electric Association, is standardizing storage batteries for use on automotive apparatus. In the formation of an Electric Storage Battery Section we should therefore limit our work to lines not already covered by the above or get in touch with the above associations before beginning standardization work.

"As to standardization of present lines of apparatus, much remains to be done. We should define such items as crane and hoist motors, elevator motors and machine-tool motors, and draw specifications for each class, defining the performance characteristics. We need also tables of horsepower capacity and speed ratings of each class. Nowhere in our Power Club rules do we give any indication of the information necessary from the customer in ordering standard or special apparatus. One partial exception to this is the specification form brought out by the Transformer Section."

Among the committee and section reports presented were those on membership, tariff, foreign trade, entertainment, transformers, motors and generators, fractional-horsepower motors, large power motors, alternating-current and direct-current generators, industrial control, portable electric tools, commercial standardization, legal, mining and industrial locomotives, general engineering recommendations, Electrical Manufacturers' Council, safety standardization, Bureau of Standards, labor, nomenclature, publicity, power switchboard and oil circuit breakers, electric measuring instruments, apparatus application, underwriters, electric safety conference, trade practices, freight classification and apparatus voltages.

SUCCESS OF THE CHRISTMAS CAMPAIGN ON MERCHANDISING

Society for Electrical Development Fills Orders for 500,000 Pieces of Printed Material—Interest Shown in Canada

Although considerably delayed and handicapped by the recent printers' strike, the Society for Electrical Development reports that its Christmas campaign is meeting with great success. Already there have been reprints made of several of the co-operative printed sales helps, and Christmas Day will see all of the campaign material out. Orders for half a million pieces of printed matter have been filled.

A noticeable increase in the material sent society members and non-members in Canada marks the entry of the Dominion actively into co-operative campaigns. In a few instances dealers have reported that, owing to the difficulty of securing merchandise, they cannot enter into active campaigns this year, but in the majority of cases retailers are going actively after business and report an unprecedented interest in electrical appliances and devices.

PURCHASE OF POWER FOR HOLYOKE DISCOUNTENANCED

Engineer Retained by City Favors Local Generation of Electrical Energy and Erection of New City Power House

The prospects of hydroelectric power being purchased by the city of Holyoke, Mass., from the Turners Falls Power & Electric Company appear to be waning, owing to an adverse report by Samuel M. Green of Springfield, Mass., a consulting engineer called into the case a few weeks since by the city government.

Mr. Green's report was submitted to a special committee of the Board of Aldermen and Chamber of Commerce at a meeting Dec. 9, and its presentation was followed by a resolution asking the Board of Aldermen to authorize the president of the board, the Mayor and the manager of the gas and electric department to negotiate for the purchase of a site for a proposed new power plant, the latter to cost about $2,500,000.

Mr. Green maintained that the Turners Falls company's proposition now before the city is not sufficiently favorable to warrant its acceptance. The latter offers a step rate ranging from 1.2 cents per kilowatt-hour for the first 1,000,000 kw.-hr. to 8.5 mills per kilowatt-hour for all energy in excess of 8,000,000 kw.-hr. On a ten-year term this would increase the cost of energy to the city by about $25,000 a year, compared with an earlier proposal of the company last summer.

FLOODS DAMAGE PLANTS IN THE SOUTHERN STATES

Torrential Rains Throughout the Southeast Bring First Relief, Then Considerable Loss to Hydroelectric Properties

Torrential rains throughout the Southeast brought first relief and then considerable loss to a number of the hydroelectric plants in that section. The more fortunate plants were enabled to shut down their steam auxiliary generating stations, thus eliminating the fuel expense and at the same time relieving their customers of the restrictions imposed by the regional coal committee on users of energy generated by fuel. Most of the streams reached unprecedented stages with consequent damage to a number of plants, the most serious damage being the loss by the Montgomery Light & Water Power Company of the dam at Tallassee. The estimated damage from the meager figures at present in hand is placed at from $250,000 to $300,000.

High water stopped the operation of the Goat Rock development of the Columbus Power Company, as well as the operation of its steam auxiliary plant at Columbus proper, while the Chestatee and Dunlap plants of the Georgia Railway & Power Company were reported badly flooded. The latter company's Morgan Falls plant was also out of operation for forty-eight hours, to dry out the ducts and transformers rendered unserviceable by high water.

The Southern Public Utilities Company had been with out service for several days from one of its smaller plants at Gregg Shoals on the Savannah River, while the river readings indicated that the Augusta-Aiken Railway & Electric Corporation was faced with a serious shutdown of its hydroelectric plant.

Owing to their remote locations and inability to get into some of these plants as yet, it was impossible at the time this article was written to get any accurate estimate of the amount of damage sustained, which will undoubtedly go into considerable figures.

Heavy rains ceased on the evening of Dec. 9 and most of the rivers had reached the maximum stage. Therefore at the time this article was written no further serious damage was expected unless additional rains should fall within the ensuing forty-eight hours.

PUBLIC UTILITY MUST SECURE NEW BUSINESS

Illinois Public Utilities Commission Authorizes "All Reasonable Efforts," but Utility Must Be Fair and Reasonable

Dismissing a complaint against the Public Service Company of Northern Illinois, the Illinois Public Utilities Commission authorizes public utilities to make all reasonable efforts to obtain new business and only places the limitation that the utility must be fair and reasonable in all its practices.

The complainants represented local firms or contractors in Chicago Heights and vicinity. They alleged unfair practices on the part of the Public Service Company in connection with the sale and disposition of merchandise and in connection with jobbing work consisting of house wiring in competition with local contractors.

The commission says in part:

Substantially stated, the complaint may be divided into two classes—(a) discrimination in prices charged by the company's representative at Chicago Heights for lamps and other merchandise, and (b) underbidding, or low prices charged for wiring houses. With respect to the first charge. testimony was offered by the complainants that one or two of their customers were charged a higher price for lamps than was ordinarily charged. This was not denied by witness for the company, but it was the contention of the witness that if discriminatory charges for lamps or other merchandise were made, it was against the policy and rules of the company to do so, and the company would give directions at once to have it stopped.

There is no contention with respect to the wiring of new houses, as the evidence shows this character of work is only performed by local contractors. But in connection with the wiring of old or existing houses witnesses for the complainants stated that the local contractors are obliged to pay the scale of union prices for labor, while the company does not and therefore is able to perform the work at much lower prices, thus depriving the contractors of the opportunity of securing the work. One instance was cited by a witness for the complainants as being very unfair in that the company's representative at Chicago Heights had given a lower price for a job of house wiring after the contractor had submitted a figure for the same job, thus depriving him of the work. In view of the law relating to public utilities and the findings the commission is obliged to make thereunder, it would appear to be unnecessary to give further details of the controversy.

While the safe of merchandise is a non-utility business, it is the expectation of the commission that this feature of the complaint will be corrected by the company, as it disclaims any intention of permitting any discrimination in prices. But with respect to house wiring, this is work performed by the company in connection with the acquisition of new business. This commission will expect that not only the Public Service Company of Northern Illinois but all public utilities will make all reasonable efforts to secure new business, to the end that the production of utility commodities shall be increased, thus decreasing the cost of production, which must necessarily benefit the consumers.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

CLASSIFICATION OF PUBLIC UTILITY RATES PROPER.—For the purpose of fixing the rates to be charged by a public utility, it is proper to place the patrons in different classes and make different rates applicable to such classes, based upon the varying cost of service rendered. (100 S. E. 551.)

MUNICIPAL REGULATION OF UTILITY RATES.—The police power to regulate rates to be charged by public utilities may be invested in a municipality without use of express language, it being sufficient if such power necessarily arises from, or is fairly implied in, or is incidental to, the powers expressly granted, or is essential to the declared objects and purposes of municipality. (184 P. 604.)

DEATH FROM DEFECTIVE INSULATION.—Where a lineman employed by one electric company brought his hand into contact with a dead, insufficiently insulated electric wire belonging to another company, thereby causing a short circuit through his body from a block and tackle charged by a high-voltage wire belonging to his employer, which was also insufficiently insulated, whereby he was killed, the death was not such a natural and probable consequence of neglect to insulate the dead wire sufficiently as to make the company owning it responsible therefor. (Washburn vs. Laclede Gas Light Company, 214 S. W. 410.)

IN ACTION TO ENJOIN GAS RATES AS CONFISCATORY, GENERAL ELECTRIC AND GAS BUSINESS NOT CONSIDERED.—In an action by a gas and electric company to have the law fixing $1 per 1000 cu. ft. as maximum for gas furnished to the general public, and the law fixing 75 cents for that quantity as the maximum for gas furnished to the city of New York, declared confiscatory and unconstitutional, the question whether plaintiff's total business, which includes its electrical department, is or is not conducted at a loss cannot be injected into the case. (Bronx Gas & Electric Company vs. Public Service Commission, 178 N. Y. 218.)

ENERGY BY HYDROELECTRIC PLANT TO INDUSTRIES A PUBLIC SERVICE.—Where a hydroelectric company, a public service corporation within the terms of the code, by its charter expressly engages to serve the public, and subjects itself unreservedly to the laws and regulations of the governmental power having jurisdiction in the place where it proposes to conduct its business, and its prolonged subsequent conduct is entirely consistent therewith, the electric service rendered by the company to industrial concerns to be used by them for private profit is a "public service," within the provisions of the public service commission act, and subject to regulation by the commission. (Mill Creek Coal & Coke Company vs. Public Service Commission, 100 S. E. 557.)

TEMPORARY RATES DUE TO HIGHER COST OF OPERATION.—A situation, due to an unexpected rise in prices and wages, which makes it altogether probable that the past and present rate is insufficient to yield a revenue which will pay that fair average return that the law requires, although not constituting what would technically be denominated an "emergency," may, when shown, be sufficient for the allowance by the commission of a temporary rate, limited to the time required for making an investigation and finding of the facts. If it should happen that the temporary rate so fixed is too high, the condition may be rectified in the order fixing the rate after investigation. (173 N. W. 690.)

POWER OF COMMISSION TO REVISE RATES NOTWITHSTANDING ORDINANCE.—That part of the proviso of an act which declares "that this act shall not . . . impair or invalidate any future contract or ordinance of any municipality, as to the public uses of such company, that shall receive the assent of the Railroad Commission" does not deprive the Railroad Commission of power, after assenting to a contract or ordinance of the character mentioned in such provision, made after the passage of the act, to revise or make new rates, where future conditions render the rates specified in the contract or ordinance unreasonable and unjust to the companies or to the public. (City of Atlanta vs. Georgia Railway & Power Company, 100 S. E. 442.)

ATTACK ON COMMISSION'S ORDERS RAISING RATES IN WAR-TIME EMERGENCY.—An order of the Railroad Commission fixing gas rates is presumed to be valid but may be attacked in the courts on the ground that it is unjust and unreasonable, or void for other cause, and where such order is attacked as being void the burden of proof is upon the party attacking it. An order of Railroad Commission as to gas rates was not void for reason of being adopted because of "an emergency arising out of national conditions existing at this time," resulting in an advanced cost of production, as it was to meet just such conditions that Legislature provided in Civil Code 1910, 2631, that commission, from time to time and when circumstances required, should change and revise schedules of rates. (100 S. E. 439.)

ELECTRIC COMPANY WAS NEGLIGENT IN INSPECTING WIRE.—In an action against an electric company brought by the administrator of a small boy whose death resulted from coming in contact with an electric wire which the company had left connected with a movable lunch room after service had been discontinued, the submission of the question whether the company was negligent in failing to inspect the wire, which by reason of the moving of the lunch room was slacked so that it lay on the ground, was held proper. The court also held that in furnishing electricity the highest degree of care which is reasonably practicable is enjoined, not imposing an undue standard on defendant, but merely requiring reasonable care under the circumstances considering the hazards of the business. (Swaczyk vs. Detroit Edison Company, 174 N. W. 197.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

PROPERTY OUTSIDE OF COMMISSION JURISDICTION.—The Arizona Corporation Commission held in a case affecting the Arizona Gas & Electric Company that although it had no authority to prescribe surcharges or in any other way adjust rates for electricity sold in Mexico, it would decline to permit increases in Arizona sufficient to care for all deficiencies in revenue, unless proper rate adjustments are made applying to the system as a whole. A surcharge of 10 per cent was authorized.

COMMISSION ALLOWS $25,000 ON ABANDONED STATION.—In a rate case of the Spring Valley Utilities Company the Illinois Public Utilities Commission has allowed $25,000 for abandoned property on the theory that the cost of this property was not completely amortized at the time of abandonment. The commission held that the public had received a benefit from the abandonment of the obsolete generating stations. It also stated that the petitioners should be allowed to benefit by at least an amount equal to that received by the public in an allowance on the fair value of the property for, at any rate, a part of the original cost of the abandoned stations.

ADEQUATE RATES FOR STREET LIGHTING.—The Salem Light & Power Company was held by the Missouri Public Service Commission to be entitled to increased street-lighting rates. "It appears in the testimony of witnesses for the city of Salem at the hearing that a rate of 15 cents per kilowatt-hour, with a minimum of $1 per month, is as high a rate as the citizens of Salem are willing to pay for commercial lighting," says the commission. "The company is clearly entitled to earn additional revenue, and it clearly appears that the increased rate proposed for street lighting is reasonable and that the schedule under suspension should be permitted to become effective. The financial inability of the city to pay additional sums for street lighting is a deplorable situation but cannot control the action of the commission in fixing reasonable rates for such service. The only way the city and the citizens of Salem can have efficient lighting service is to pay rates therefor sufficient to enable the company to pay at least its operating expenses and an amount sufficient to pay at least its fixed charges and some return upon the balance of its investment. Either the city must pay the additional rate, or it must curtail the number of lights which it takes, or the private consumers must pay increased rates for the services which they receive. The rates for commercial lighting are not involved in this case, and the commission will not undertake to make any order in respect thereto."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

EMPIRE COMPANY HAS NEW RATE SCHEDULE.—The Empire Gas & Electric Company, Geneva, N. Y., filed with the Public Service Commission, Second District, a new schedule of rates to take effect on Nov. 25.

CAMPAIGN FOR ELECTRICAL INTERESTS IN KANSAS CITY.—The Chamber of Commerce of Kansas City is carrying on an advertising campaign to popularize the use of electricity and electrical appliances. The advertising will be done under the title "Electrical Interests of Kansas City." The expense will be carried in equal proportions by central stations, jobbers and manufacturers, and contractors and dealers, at an estimated cost of $7,000 to $8,000 per year.

JAPANESE COMPANY INSTALLS TWO LARGE TURBINE UNITS.—Two 25,000-kw. steam-driven turbine units of Westinghouse make, which will complete the largest steam-driven electrical installation in the Far East, are now being erected at Osaka, Japan, for the Osaka Electric Light Company. Situated in an extensive industrial district, this company furnishes light and power to street railways, steel works, shipbuilders, copper-refining plants, paper mills, electrochemical installations and other industries. It is noteworthy that in 1908 the Osaka company installed three steam turbine units of 3000 kw. each. In 1910 two more units of like capacity were added, and in 1911 two 5000-kw. units. The 25,000-kw. units now being installed will bring the capacity of this plant up to 100,000 hp. All of the above units are of Westinghouse manufacture.

VILLAGE OF ATTICA TO SELL PLANT.—The village of Attica, N. Y., has asked the New York Public Service Commission, Second District, to approve the sale of its electric plant for $12,500 to the Genesee Light & Power Company, Batavia. This follows an election on June 10 at which the village voted 111 to 2 in favor of the sale. The village had owned the plant since Dec. 29, 1916, when it voted, 187 to 25, to acquire an existing plant and operate it publicly. It paid $12,000 for the plant. The old company charged 12 cents per kilowatt-hour for from 1 kw-hr. to 10 kw.-hr. per month, graduating to 5 cents per kilowatt-hour for 500 kw.-hr. per month. Under existing rates, the village charges 14 cents per kilowatt-hour from 1 kw.-hr. to 20 kw.-hr. per month, graduating to 5 cents per kilowatt-hour for from 500 kw.-hr. to 1000 kw.-hr. and 3 cents for more than 1000 kw.-hr. Attica for the year ended Feb. 28, 1919, had 161 service connections, and its operations, under increased rates, resulted in a net income of only $203, without any charge for amortization included. Sales of electrical energy totaled $7,842.

ENGINEERS IN THE CENSUS.—As a result of the Engineering Council's request to the Director of the Census, the national service committee has been successful in effecting a reclassification of engineers so that all technical engineers will be listed as such, separately and distinctly from the non-technical engineers. Thus the next census will bring an enumeration of all technical engineers together as one unit under the main heading of civil, mechanical, electrical and mining. Architects will also be enumerated separately in the census returns.

UNITED STATES NITROGEN CORPORATION.—Among other powers suggested for the proposed United States Fixed Nitrogen Corporation is the operation of the hydro-electric power plant now being constructed at Muscle Shoals, Ala. The corporation would undertake the manufacture and development of the products of atmospheric nitrogen for military and agricultural purposes. All of the stock would be controlled by the government and the corporation would be directed by a board of directors to be chosen by the Secretary of War.

SAFETY SWITCHES FOR ALTOONA.—C. S. Downs, city electrician for Altoona, Pa., has asked the co-operation of the electrical contractors of the city in putting into effect a rule which requires inclosed externally operated main service switches on all installations except those constantly operated by competent electricians. This amendment to Altoona's electrical ordinance also specifies that service wires must be run from the point of entrance to the switch cabinet in continuous iron conduit, the point of entrance being at least 10 ft. above the ground.

GENERAL ELECTRIC INTEREST IN RADIO CORPORATION.—Stockholders of the Marconi Company of America have voted in favor of the absorption of the company by the Radio Corporation of America. The General Electric Company contributes $2,500,000, part of which will be used to purchase shares of the Marconi Company of America held by the British Marconi Company. Of the capital of 5,000,000 shares of 7 per cent preferred stock (par value $5) and 5,000,000 shares of common (no par value) of the new corporation the General Electric Company will receive 135,174 shares of preferred and 2,000,000 shares of common.

GENERAL GAS & ELECTRIC COMPANY EXPANSION.—The General Gas & Electric Company, through the acquisition of all the common stocks, now controls the following companies: Metropolitan Edison Company (including Pennsylvania Utilities System), Reading Transit & Light Company, and Vermont Hydro-Electric Corporation. In addition to the above, the General Gas & Electric Company will retain its interest in and remain in control of the following companies: New Jersey Power & Light Company, Sandusky Gas & Electric Company, Binghamton Light, Heat & Power Company, the Northwestern Ohio Railway & Power Company, Port Clinton Electric Light & Power Company, Rutland Railway, Light & Power Company, Pittsford Power Company, and Sayre Electric Company. The total population served is estimated, as of Dec. 31, 1918, at 851,875.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

ELECTRIC CLUB OF CHICAGO.—S. J. Duncan-Clarke addressed the club at its Nov. 18 meeting on "A Plea for Sane Internationalism."

A. I. E. E., BALTIMORE SECTION.—Prof. R. W. Wood of Johns Hopkins University spoke on "Signaling in War with Invisible Light" at the Oct. 24 meeting held by this section of the American Institute of Electrical Engineers.

MR. DOW'S ADDRESS POSTPONED.—The address which Alex Dow of the Detroit Edison Company was to give Dec. 16 before a joint meeting of Chicago engineering societies on design and operation of steam-turbine plants was canceled on account of the coal shortage. Mr. Dow will speak later.

OKLAHOMA UTILITIES ASSOCIATION.—This association has created the office of public service secretary, and the appointee is to have charge of a speakers' bureau, the publication of a state journal and general publicity work for the association, which will consist of keeping in touch with the newspapers and the trade magazines.

A. I. E. E., ST. LOUIS SECTION, AND ASSOCIATED ENGINEERING SOCIETIES OF ST. LOUIS.—D. M. Jones of the engineering department, General Electric Company, delivered an address entitled "Static Condensers" before the St. Louis Section, American Institute of Electrical Engineers, and the Associated Engineering Societies of St. Louis, meeting jointly on Oct. 29.

NEW YORK ELECTRICAL LEAGUE.—At a luncheon given by the league in New York City on Nov. 12 Colonel J. J. Carty, vice-president of the American Telephone & Telegraph Company, was the guest of honor and made the principal address. He spoke on the accomplishments of the American Signal Corps during the war and related some interesting incidents which had come to his notice while in the service.

CALIFORNIA ELECTRICAL CO-OPERATIVE CAMPAIGN COMMITTEES.—A meeting of the advisory committee of the California electrical co-operative campaign was held at Fresno and at Crane Valley Dam on Oct. 25 and 26. At Crane Valley Dam the committee was entertained by the San Joaquin Light & Power Corporation and taken over the corporation's new work including the building of the Kerckhoff Dam. Among the work accomplished by the committee in its session was that of the adoption of a standard form for rating of the various contractor-dealers throughout California and also the discussion of new and effective means of publicity that will tie in with all phases of activity in the electrical industry in the West.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

James H. Wilkerson, formerly United States district attorney, has been appointed chairman of the Illinois Public Utilities Commission by Governor Lowden to succeed Thomas E. Dempcy of East St. Louis, who has resigned on account of ill health. Mr. Wilkerson has been a member of the commission for some time, having been appointed to the commission to fill the vacancy left by Fred E. Sterling of Rockford, Ill.

Dr. V. Bush has been appointed associate professor of electrical engineering at the Massachusetts Institute of Technology. He is a graduate of Tufts College, electrical course, and received the degree of M. S. there in 1914. In 1916 he was given the degree of doctor of engineering at the Institute. He served as an instructor at Tufts and later as assistant professor, and during the war was identified with the research work of the United States Navy at New London, Conn., for submarine detection. He is now engineer of the American Radio & Research Company, and a portion of his work at the Institute will include advanced lectures to post-graduate students and investigations.

M. S. Sloan, president of the Brooklyn (N. Y.) Edison Company, has been appointed by President R. H. Ballard of the National Electric Light Association chairman of the recently formed committee on electrical resources of the nation. Mr. Sloan is organizing a committee representative of all branches of the industry to handle this subject. The committee's report to be presented at the next annual convention will be in the nature of a textbook and it is stated will be of particular assistance to the small companies throughout the country. The present status of electrical development in the United States, both private and municipal, will be noted and comparisons drawn between different sections of the country and between private and municipal operation. An extended biography of Mr. Sloan appeared in the Electrical World, Aug. 2, 1919.

E. L. Milliken, until recently manager of the Houghton County Traction Company and the Houghton County Electric Light Company, Houghton, Mich., has been appointed manager of the Houston (Tex.) Electric Company. Mr. Milliken succeeds David Daly, manager of the Keokuk (Ia.) properties of Stone & Webster, whose appointment to the latter post was announced in the Electrical World for Oct. 4. Mr. Milliken was born at Biddeford, Me., in 1888 and was educated at the University of Maine, from which he was graduated in 1908 with the degree of bachelor of science in electrical engineering. Upon his graduation he joined the Stone & Webster organization, with which he has been connected since 1908. During September and October 1908 he was engaged in the statistical department of the Stone & Webster Management Association. In November of the same year he entered the service of the Cape Breton Electric Company, serving in the capacity of clerk to the manager and later as superintendent of distribution and electrical engineer and also acting as superintendent of light and power. In May 1912 he became manager of the company, retaining this position for five years. In October 1917 he was appointed manager of the Houghton County Traction Company and the Houghton County Electric Light Company.

Russell W. Stovel, who recently returned from France, where as lieutenant-colonel of engineers he served as chief of the terminal facilities division of the Army Transport Service, has been appointed a consulting engineer of Westinghouse, Church, Kerr & Company, Inc., and, as a member of that organization, will devote his entire time to the company's electrical and mechanical work. Mr. Stovel has had an unusually comprehensive experience in the electrical and mechanical problems connected with central power station and steam railroad electrification work. He was graduated from McGill University, Montreal, in 1897 with the regree of electrical engineer, and the following year entered the employ of Westinghouse, Church, Kerr & Company. He soon became an assistant engineer, then successively engineer-in-charge and mechanical engineer of the company, and finally a managing engineer. In 1914 Mr. Stovel became managing engineer for Gibbs & Hill, consulting engineers, of New York. Mr. Stovel has designed a number of important power plants and had charge of many well-known electrifications, including the Paoli and Chestnut Hill electrifications of the Pennsylvania Railroad, the Elkhorn Grade electrification of the Norfolk & Western Railway and the electrification of the New York Connecting Railway.

RUSSELL W. STOVEL

Major George E. A. Fairley has become a member of the electrical engineering staff of the Bethlehem Steel Company. He recently received his commission as major of engineers in the National Guard Reserve of Maryland. Major Fairley was assistant chief engineer of the Baltimore Electrical Commission from 1913 until he volunteered for army service in 1917 and served sixteen months in France in command of the 511th Engineers.

Frank M. Kerr, vice-president and general manager of the Montana Power Company, has been appointed by President R. H. Ballard of the National Electric Light Association chairman of the committee on steam railroad electrification. The Montana Power Company, of which Mr. Kerr is the operating executive, is now furnishing the power supply for the operation of 657 miles of the Chicago, Milwaukee & St. Paul Railroad in Montana and the Pacific Northwest. R. Beeuwkes, electrical engineer Chicago, Milwaukee & St. Paul Railroad, will act with Mr. Kerr on this committee. Mr. Kerr has been associated with the Montana Power Company for many years. He succeeded the late Max Hebgen, who died Aug. 24, 1915, as general manager of the system.

E. B. Wayts has become associated with W. N. Albertson & Company of Milwaukee, Wis., and will have charge of all of the company's engineering and construction problems. Mr. Wayts is also general superintendent of all inside and outside work. He began in 1896 in the shops of the Union Traction Company of Indiana; in 1902 he was engaged in substation operation, and in 1906 he was foreman in the shops of the Indianapolis & Eastern Traction Company. From 1908 to 1913 he was in South Dakota for the Chicago, Burlington & Quincy as superintendent of interurban lines, power and electric lighting. In 1913 he became superintendent of the water and lighting department at Downers Grove, Ill. In 1915 he was appointed superintendent for the Marshfield (Wis.) municipal water, electric light and power plant.

Alonzo R. Weed, formerly chairman of the Massachusetts Gas and Electric Light Commission, is a member of the new Department of Public Utilities of Massachusetts. He is a native of Bangor, Me., and was educated at Harvard College and Boston University Law School, receiving the degree of LL. B. in 1890. Mr. Weed has practiced law in Boston for twenty-nine years and is a member of the firm of Brewer, Weed & Weed. He has been an instructor in equity and in equity pleading in Boston University and has been a member of the Gas and Electric Light Commission since 1906. He succeeded Forrest E. Barker as chairman upon the death of the latter in 1914. Mr. Weed's work as chairman of the commission which now goes out of existence after about thirty-five years of gas and electric utility regulation has been an able continuance of the traditions established by his predecessors, characterized by a broad comprehension of the economic changes forced upon the companies by the war and a delicately poised sense of just relations between the utilities and the public which they serve.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

WIRE SITUATION IMPROVING IN THE CHICAGO TERRITORY

Stocks of Housewiring Sizes Are in Fair Shape— Smaller Sizes Are Difficult to Get on Account of Shortage of Labor

The wire situation has improved in the Chicago district. Manufacturers have caught up with the demand in the standard housewiring sizes such as No. 6. The majority of building construction, especially in Chicago, which has been started since the recent building strikes has been along the lines of large apartments, besides some factories, and these have not yet reached the stage where wiring is done. Consequently jobbers' stocks have built up in fair shape. However, the smaller sizes and lamp cord which is made of small drawn wire are still hard to get. This is probably accounted for by the scarcity of labor in the drawing mills. Copper is fairly plentiful, and it is more profitable to draw 100 lb. of copper to No. 6 wire than to No. 18 or No. 31 such as is used in lamp cord. The labor and care required are much less.

Slight price increases have been made on the smaller sizes, but they are not sufficient to cause the wire drawer to shift his very limited supply of labor to these sizes in which his gross volume of output will be much less.

SWITCHBOARD INSTRUMENT SALES STEADILY INCREASING

Past Year's Sales Expected by Manufacturers to Surpass Those of 1918, and Favorable Market in 1920 Foreseen

In a canvass of the representative manufacturers of electrical switchboard instruments, an attempt has been made recently by the ELECTRICAL WORLD to ascertain the condition of the market for switchboard instruments through the year 1919, and especially the latter part, and also to give some idea as to the manufacturers' views for the 1920 market. Although a few reports show that 1919 sales will be as much as 20 per cent below those of 1918, most manufacturers expect their sales to be well over those of 1918, and in one case even 100 per cent. One qualifying factor has been observed, however, which would tend to keep down the volume of present sales. This is the effect which the labor situation might have on business. Increased labor troubles during the month of December and a possibility of their continuance during the early part of 1920, it is thought, would act as a damper on the market for switchboard instruments and would keep 1919 sales from going much over those of the previous year.

Current sales are reported on the increase, as a rule, and show general improvement over the early part of the year. The current sales of one manufacturer are the largest of that factory. The month of October was reported as the record month in its experience.

In the matter of shipments it is more difficult to obtain all the data which might prove interesting. Shipments as a whole are growing longer, and although a low range has been set at two weeks, manufactures are as high as two months. Not only is the excess work in hand a contributing cause to slow shipments, which are far from normal in certain cases, but deliveries of material from the outside are slow and also help delay the finished product. In one case shipments are reasonable, but productive facilities are being rapidly loaded up for the remainder of the present year and part of next year.

There have been no recent advances in price, except in a few spots to make complete the adjustments started some time ago. There seems to be a very convenient answer to the price question in that prices may go upward, but no definite basis for any increase has been reported. Of course, increasing costs must inevitably force a higher level of prices, but no time for increasing costs has been set.

Manufacturers as a whole regard the 1920 outlook as very favorable, although in one case it is not expected that sales will be increased until public utilities again come into the buying market. On the other hand, it is shown that additional generating equipment with switchboards will be required to serve the increasing resident consumers, and unless labor conditions disturb business, a prosperous year is expected in 1920. In this connection other manufacturers are of the opinion that labor unrest is very much improved and that projects now delayed will be rushed to completion without fear of interruption.

THE WEEK IN TRADE

REGULATIONS enacted because of the recent fuel shortage were responsible for a lighter demand for electrical materials in the South and Middle West. In New England and the Eastern States there was no let-up in the unusually heavy demand for materials, as coal supplies here were better able to stand the strain. Along the Pacific Coast, especially north, abnormally cold weather for a few days stopped building and even several lines of business, and Christmas buying hesitated.

During this time heaters and heating-ware sales have been heavy throughout the country and stocks are low. In evidence of this one prominent manufacturer has notified his employees that he will be unable to supply them with the company's heating appliances this Christmas as his factory is six months behind on orders. Other stocks, too, have been hit hard. Low-voltage porcelain and non-metallic conduit in the East are short, and in New England stocks of flexible armored conductor are almost exhausted.

Shipments in several lines are lengthening, and in the South deliveries are slower. Production of schedule material is reported better in New England, and sockets are coming through in sufficient quantity to relieve the shortage temporarily, it is stated.

Prices are holding well, even with the general shortage in stocks, and few advances have been recorded in the past week.

NEW YORK

Business is running ahead of supply in a sellers' market. At that, prices among the jobbing trade are quite firm. The week has uncovered virtually a constant price market. Steel and iron prices have advanced in the last two weeks about $5 a ton, on the average, so an advance in steel electrical products would not be unexpected in the near future.

There is a further shortage in certain steel products because of coal shortage at some mills. Steel-strip supply is lighter and armored conductor production is thereby expected to suffer, but only to a small amount. Copper wire mills, both rod and insulating, have lots of work and are well supplied with raw material since the falling copper market of the last two weeks. Lamp and heater cords are particularly short. Jobbers' stocks of Christmas ware are low and spotty, and although air-heater

shipments are coming through on old orders, a shortage in some lines exists.

Several large commercial buildings were projected in the Manhattan district last week, particularly for the garment industry. Building contracts awarded in this territory for the eleven months of 1919 are 25 to 30 per cent higher than those for the same period last year. In some localities building contractors report a little easier labor supply, although material supply is still short.

RIGID CONDUIT.—Stocks are in spotty condition although contractors seem to be getting sufficient for their daily needs. Prices on ½-in. black are quoted around $70 and $75. Allotments to certain jobbers are larger than requirements.

FLEXIBLE ARMORED CONDUCTOR.—Failing coal supplies caused a slight decrease in output of steel strip. Contractors away from points of distribution are beginning to suffer from lack of the finished conductor. Single strip is selling for $85 or $86, and double strip about $88.

WIRE.—Bare base is 22 cents, rubber-covered base average 28.5 cents and weatherproof base about 28 cents. Wire mills are running under full capacity with shipments around thirty days. Orders are increasing monthly. Producers took advantage of the recent falling copper market and laid in heavy stocks of materials.

CORDS.—There are no heater cord stocks, and producers are requiring about eight weeks to ship. No. 18 is bringing around $41 per 1000 ft. There are likewise no lamp-cord stocks, and about ten weeks are necessary to fill orders. Prices on No. 18 twisted are $20 to $23, while No. 16 is bringing $27.50 to $29.

LAMPS.—Jobbers' stocks are broken with some of the most common household sizes out.

CROSS-ARMS.—Prices advanced Dec. 13 on yellow pine cross-arms $10 per 1000 ft.

BOSTON

Business continues at floodtide. Prices are firm, with little change. Jobbers' stocks are hard hit in many lines, with little chance of replenishment before the turn of the year, but a better supply of schedule material is noted. Building operations are going forward well, the weather having been suitable for outside work. Collections are still fairly good, though not up to the standards of last year at this time. The holiday trade in appliances surpasses all previous records. Important new hotel construction in Boston and in Hartford, Conn., is forecast, and the opinion finds many adherents that considerable central-station expansion will take place next year.

WIRE.—Large distributers stated Monday that the supply of wire is now much more satisfactory, even in smaller sizes. Bare copper wire quotations are on 23 cents base, weatherproof at 27¼ to 28 cents, and rubber-covered ranges from 25 to 30 cents. A leading distributer of No. 14 rubber-covered wire declares that plenty of this product can now be had.

SOCKETS.—Production is thought to be nearly if not quite up to normal, and recent shortages of pull sockets are considerably relieved for the present. In case lots sockets are quoted as follows: Key, 30 cents; keyless, 27 cents; pulls, 47.5 cents. The demand is healthy and the brass supply ample.

KNOBS AND TUBES.—Porcelain fittings very scarce. Tubes, 3-in. size, quoted at $7.50 per 1000 in barrel lots, but are very hard to get. "Nail-it" knobs are non-existent in some jobbers' bins, and in the few cases where sales can be made are quoted around $22 to $22.40 per 1000, in standard packages.

RIGID CONDUIT.—Prices are steady, quoted on Card 43, but there is a decided shortage of ½-in. and ¾-in. black and white pipe.

MOTORS.—The demand for motors below 50-hp. rating is remarkably active. A few single-phase motors of very low rating may be picked up now and then, but in the main the New England market is "shot to pieces" as to small motor stocks. Prices are firm, and second-hand motor dealers are doing a good business.

METALLIC FLEXIBLE CONDUCTOR.—The market is almost bare. No. 14, single-strip, is quoted around $85 per 1000 ft., net. The demand is very vigorous.

SNAP SWITCHES.—Competition is acute, in spite of a reasonably good supply. Discounts run from 17 to 25 per cent off list, according to the size and rivalry for orders.

CHICAGO

Electrical retailers and jobbers have suffered from the curtailment of business hours on account of the coal shortage. This is especially true of jobbers, who have been working overtime two or three nights a week trying to catch up with orders. Some jobbers estimate that their loss of business amounts to 30 per cent. The six-hour day has still further lengthened shipments from factories, but as yet the effect has not been felt by jobbers. For a number of months to come the only limit to sales seems to be the output of the manufacturers. Building permits for the city of Chicago amounted to $1,300,000 for the week. A housing corporation intends to erect in Chicago 170 two-story brick residences at a cost of $4,000 each.

WIRE.—Wire prices remain firm in spite of the continued decrease in cost of copper. Stocks of all except the smaller sizes are in fair shape. A 30-cent base is quoted on rubber-covered and weatherproof.

GLASS INSULATORS.—One maker has put into effect some price increases, and it is to be expected that other makers will do the same. The Hemingway No. 19 insulator is still selling at the old price of $56.65 per 1000 in 1-barrel to 10-barrel lots, f. o. b. factory.

HIGH-TENSION INSULATORS.—A demand from the Western States is noted, especially for the link type of insulator. Shortage of coal at the kilns has increased time of deliveries to about eight weeks. A 33,000-volt pin insulator is quoted at $1.80, and the link type are quoted at $3.25 each.

SECTIONAL SWITCH BOXES.—The price on these switch-boxes, as on other steel and iron fabricated goods, has advanced. The Gem D box has been raised from 17½ cents to about 19 cents net.

INDUSTRIAL HEATING APPARATUS.—Manufacturers of apparatus such as electrically heated solder pots, small baking ovens, etc., are three or four months behind on shipments.

INDUSTRIAL CONTROL APPARATUS.—Three or four months' delivery is the best that is promised by makers of control apparatus. Starters, switchboard fittings, etc., are having a large demand.

ATLANTA

A slight slackening in demand is reported by jobbers, occasioned in all probability by the sharp curtailment of industrial operations brought about by the coal regulations. Jobbers report that shipments on practically all lines of material are coming in so slowly that it hinders the accumulation of stocks or the filling of the large number of back orders.

An advance in price on a number of lines is to be noted, traceable to the coal and steel strike and car shortage. This price increase does not seem in any way to slacken the brisk demand.

CONDUIT.—The demand shows no signs of easing up, and because of poor shipments, jobbers have been unable to accumulate any stock of rigid conduit in the more popular sizes. Promised shipments fail to materialize, and the shortage will probably continue for some weeks to come.

PORCELAIN.—The shortage of porcelain in the Southeast is becoming more acute, with jobbers placing orders for expected requirements six months hence. Stocks are spotty with a shortage in sight unless shipments are received in the near future.

FLEXIBLE ARMORED CONDUCTOR.—A slight slackening of demand is noted, probably because of a falling off in apartment-house construction. This condition is temporary, as it is expected that additional building will be commenced in the very early spring. Stocks are slowly getting in fair shape despite very poor shipments. Prices are quoted as follows: Two-wire, No. 14, 2500 ft. to 5000 ft., $10.55 per 100 ft.

CROSS-ARMS.—Cross-arms registered a price advance of 10 per cent. The demand is brisk with stocks in fair condition, and shipments of approximately four weeks are the rule. One large jobber reports another expected advance in price about January. Prices: Washington fir, in quantities from 1000 to 2000 lineal feet, four-pin arm, 5 ft., 88 cents; two-pin, 3 ft., 55 cents.

POLE-LINE HARDWARE.—A 10 per cent increase in this hardware is noted this week. Stocks are reported in fair condition despite the brisk demands. Shipments are fair, with the

prospect that they will hold up sufficiently well to supply the demands of the immediate future.

WIRE.—The price on wire seems to have settled to a more logical level and is quoted to-day by jobbers as follows: Rubber-covered, 28 cents; weatherproof, 29 cents. The receipt of a large shipment of weatherproof by one of the largest jobbers in this section has considerably relieved the acute shortage in the popular sizes, which was beginning to be keenly felt. The demand, however, continues to exceed the supply with no prospects of a let-up.

NON-METALLIC FLEXIBLE CONDUIT.—Demand so far exceeds supply as almost to exhaust present and immediate future supplies of this commodity. Prices: 2500 ft. to 5000 ft., ⅛-in., $3.36; 7/32-in., $3.08.

MOTORS.—Conversion of steam mechanical drive to electric drive and the continued growth of a large number of new industrial plants throughout the territory has created a steady demand for all popular sizes of motors. Jobbers report slight improvement in shipments. Stocks, however, are in poor condition.

SEATTLE

Extreme cold weather for this section of the country has seriously affected business. The steel shipyards, lumber mills and larger industries working men outside have closed until conditions resume something approaching normal. Previous to the cold spell Christmas buying was proceeding with a rush. The decrease, however, has given local jobbers and dealers a chance to replenish fast vanishing stocks.

Several local jobbers report that sales of electric tableware for gifts have never been equaled and that washing and sewing machines sales promise to set a new high-water mark. Stocks of sewing machines are very low, in fact in some instances entirely depleted. The demand for Christmas tree lighting outfits shows a decided increase over last year, although it is not very heavy yet. Despite winter weather, with the exception of the past few days, new building shows a decided increase. A number of large lumber mills have closed down in spite of the daily growing demand for lumber for both export and domestic shipments. Shipments are coming through as well as can be expected.

Porltand territory reports that severe winter storms during the past week caused practically a suspension of all business for two or three days. Although later reports showed business was beginning to pick up again, no shipments are being made out of the city. The jobbers are delivering to the freight depots as orders come in, so that the goods will be ready for shipment as soon as freight movement again starts. Jobbing supplies in many lines of household appliances are practically exhausted.

HEATERS.—Jobbers' supplies are practically exhausted under unprecedented demand. Hot-plate sales are also very heavy.

ELECTRIC PADS.—Several of the largest retailers report stocks all sold out in face of heavy and sustained demand. The local factory is rushed to capacity but unable to meet requirements.

RANGES.—Both jobbers and central stations report slight increase in volume of sales. In many residences under construction plans have been made for electric range installations. Stocks are in good shape and no recent increase in price is noted.

LAMPS.—Sales show a slight decrease, especially for commercial lighting. Residence lamps are going well. Stocks in all sizes are good and prices steady.

SAN FRANCISCO

Several weeks of rain were followed by freezing spells and heavy frost which did considerable damage, especially to olive and orange crops. The rainfall so far is about two-thirds of normal for this period. From present indications, the shipyard strike has been definitely broken. The settlement of the coal strike is expected to relieve the shortage of stocks caused by slow-moving, or coal-bound, Western shipments.

HOLLOW-WARE.—The call is vigorous and well proportioned between the different articles. A few last-minute shipments of stock have relieved the situation, but many dealers are receiving only a small proportion of their back orders. The largest demand is for toasters.

WASHING MACHINES.—The latest development of the washing-machine game in California has been the establishment of several service stations to take care of repairs and adjustments. December marked an advance in price, the swinging-wringer machine advancing to $150 and an oscillating machine to $185.

CHRISTMAS TREE OUTFITS.—The demand does not differ from that of previous years, but there are better stocks on hand near the end of the season than there were during last year. There is little call for fancy lamps, principally for the reason that there are no stocks to satisfy such a demand and it is discouraged. It is reported that a Japanese make of carbon fancy lamp has been introduced and has sold fairly well.

SOCKETS.—There has been a wonderful call for sockets and receptacles of all standard house-wiring types, and this demand has about exhausted local stocks, so that some dealers find themselves with hardly a socket on their shelves for even retail orders. Combination sockets and current taps are in good demand and so are multiple plugs. A surprising feature of the last item is the number of calls for three-and four-light plugs.

METAL MARKET SITUATION

Copper Market Firm at 18.50 Cents Under Rather Heavy Volume of Sales

Copper prices have held virtually without change during the past week. The regular quotation on electrolytic is 18.50 cents a pound, and this figure was slightly shaded a week ago. Sales have fallen off since the heavy buying of two weeks ago, but the trading of last week was considered quite satisfactory. Domestic consumption came in for a fair share of the buying. Electrical manufacturers are in a good way with respect to copper stocks to hold them into the first quarter of the new year. Most of the domestic sales have been for spot and first quarter. The 18.50-cent price is holding in general for this period, although some producers are holding for 18.75 cents for March. Prices to seconds are still in the neighborhood of 1 cent to 1.50 cents higher than to consumers. This outside market is rather quiet and prices are firm.

The American Smelting & Refining Company's advance in lead price of 10 points to 7 cents a pound on Dec. 12 was hardly unexpected. Buying has been heavy but has dropped off a bit because producers have little stock to offer. The outside market is about 15 points higher, but the stock of lead is small and trading is not in large volume.

The zinc market is slightly lower than it was last week, with quotations of 8.55 to 8.60 cents. The buying of galvanizers has been constant but conservative because of conditions in the steel industry.

The scrap market is showing higher prices on the coppers and brasses. Firmness in the new metal market has probably been reflected in the scraps with ½ cent increase in brass and copper scraps and ¼ cent in lead. Scrap zinc remains unchanged.

NEW YORK METAL MARKET PRICES

	Dec. 8	Dec. 15
Copper:	£ s d	£ s d
London, standard spot	101 10 0	102 17 6
	Cents per Lb.	Cents per Lb.
Prime Lake	18.50 to 19.00	19.00
Electrolytic	18.25 to 18.50	18.50
Casting	18.25 to 18.50	18.25
Wire base	21.50 to 22.00	21.50 to 22.00
Lead, trust price	6.90	7.00
Antimony	9.50	9.62½
Nickel, ingot	41.00 to 42.00	41.00 to 42.00
Sheet zinc, f. o. b. smelter	11.00	11.00
Spelter, spot	8.72½	8.55 to 8.60
Tin	54.00	53.75
Aluminum, 98 to 99 per cent	32.00 to 33.00	32.00 to 33.00

OLD METALS

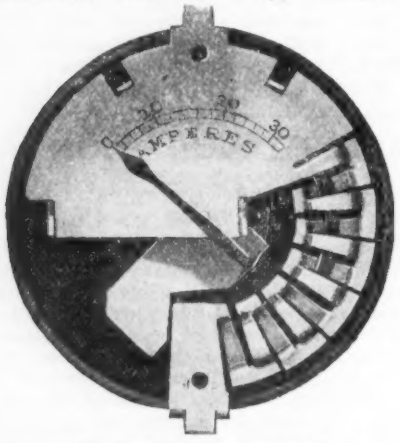
	Cents per Lb.	Cents per Lb.
Heavy copper and wire	16.50 to 17.00	17.00 to 17.50
Brass, heavy	9.00 to 9.50	9.50 to 10.00
Brass, light	7.50 to 7.75	7.75 to 8.25
Lead, heavy	5.50 to 5.75	5.75 to 6.00
Zinc, old scrap	5.00 to 5.25	5.00 to 5.25

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Ammeter of Simple Construction

The chief feature of the new "Mac" ammeter pointed out by its maker, the Metric Appliance Corporation of 299 Broadway, New York City, is that a



COIL SERVES MANY PURPOSES

brass punching serves not only as the coil or solenoid but also as the dial plate, terminals for the instrument and mounting support for the armature and springs, and, in addition, helps to hold the glass and the cover of the meter in place.

The coil is formed by punching out of sheet brass zig-zag strips which are alternately bent upward and downward. A stamped armature carrying the indicator is placed on a pivot fixed in the punching and the whole is sprung in a composition insulating case, thus making an ammeter of simple design and construction.

The new ammeter has a range of 0 amp. to 30 amp., and its terminals are so arranged on the back of the case that to test dry cells they are just placed on the battery's binding posts, without the use of wires.

Narrow Safety Fuse Panel

For apartment or residential use where distributing panels without switches are desired the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed its type "F" safety fuse panel.

The plug fuse holders of this panel are mounted on a slate base and a molded micarta cover is provided through which the fuse holders alone project, all other parts being completely covered. Therefore when the fuses are in place, it is pointed out, everything accessible is dead so that accidental contact with live parts is impossible. By removing this cover, however, all terminals are exposed so that the installation of the panel and repairs can be effected.

Another feature of the new panel is stated to be its narrowness. It is made for two-wire and three-wire mains of from 30 amp. to 200 amp. rating, 125 volts. The number of circuits is from four to thirty-two. Main fuses or a safety-type main switch can be added if desired.

Automatic Air-Compressor Outfit

Primarily for the inflation of pneumatic truck tires and the heaviest tire-filling service, the Black & Decker Manufacturing Company, Towson Heights, Baltimore, Md., has designed and brought out its No. 46 portable automatic electric air compressor outfit, which

FOR HEAVY TIRE-INFLATION SERVICE, ETC.

has a capacity of 6 cu. ft. (0.16 cu.m.) of free air a minute and a guaranteed pressure of 200 lb. Like other air compressors made by this company, the new outfit has its motor, gear train and compressor inclosed in one housing, whose top covering is removable in three sections.

An automatic switch starts the new compressor when the pressure in the tank drops to 150 lb. and automatically stops it when the tank pressure has reached 200 lb. In conjunction with this automatic switch there is an automatic unloader to prevent overloading the electric circuit when the motor is started.

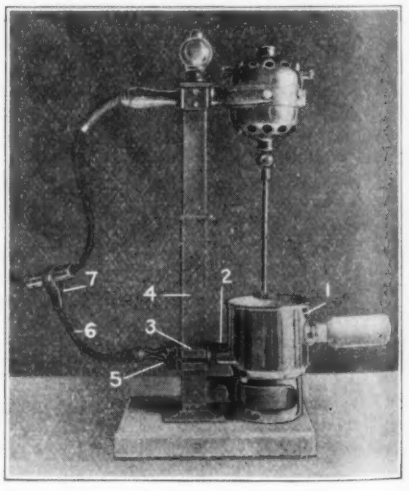
Fuse Plug

An Edison type porcelain fuse plug rated at from 3 amp. to 30 amp. is now being made by the Whitman Electric Manufacturing Company, 352 South Avenue, Whitman, Mass.

Elecric Heating Cup for Drink Mixers

For use in connection with electric beverage mixers having upright stanchions the Calorex Corporation of 12 West Twenty-second Street, New York City, has brought out its "Hot-O-Mix" electric heater, which is designed for service in soda fountains, lunch rooms, etc., to heat an individual drink while it is being mixed.

The heater comprises a nickel-plated or silver-plated heating cup (No. 1 in the accompanying illustration), 4¾ in. high and 3½ in. in diameter, with a white-enameled or polished black handle. Within the cup and near its bottom is a circular metal-incased heating element 2 in. high and 3/32 in. thick, with ample clearance from the inner sides of the cup to be easily cleaned. About 30 sq. in. of heating surface are said to be presented for heating the contents of the cup. The terminals of the heating element pass through the side of the cup to outer terminals, shown at No. 2, which are insulated by watertight bushings. Detachable insulated plug receptacles, No. 5, are held in position by nickel-plated clasps (3), which are attached by a small tightening nut and bolt to the stanchion of the mixer (4). The receptacles are electrically connected to the cable supplying current to the mixer by the short cable (6) and the connector (7). The heater can be used on alternating current and direct current of 110 volts to 120 volts.



REMOVING CUP AUTOMATICALLY DISCONNECTS CURRENT

The necessary electrical connections for the heater can be quickly attached to an electrical mixer, it is declared, without interfering with the use of the mixer for serving cold mixed drinks.

Battery-Charging Voltage Regulator

Made for operation on direct-current lighting or power circuits, the DCG type battery-charging voltage regulator now being marketed by the U. S. E. M.

USES PRIMARY CURRENT ONLY WHEN CHARGING BATTERIES

Company of 301 West Thirty-seventh Street, New York City, automatically starts and stops the charging of the cells. The new device, which is known as a "potentiostat," has a trouble lamp to signal low voltage of the batteries and an ammeter and a voltmeter for indicating both charge and discharge.

For bell ringing and other purposes where a low voltage is desired the maker states that use can be made of this device.

Household-Type Water Heaters

Two styles of "Hotvent" electric water heaters for heating the water in boilers

CIRCULATION TYPE FOR BOILER USE; MADE OF BRASS

of residences have been placed on the market by the Aetna Electric Appliance Company of Boston. One is known as the kettledrum type and is installed outside of the boiler, while the other is called the tank-insert type and is placed inside the boiler.

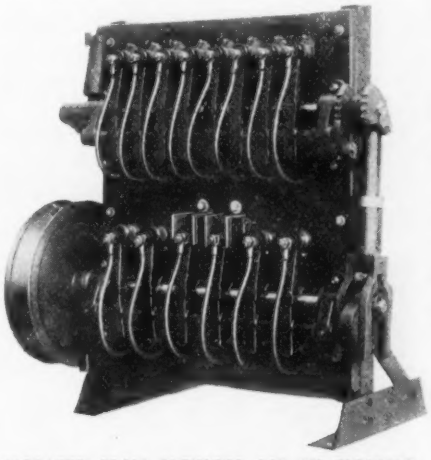
The new heaters are of the circulation type and use General Electric cartridge-type heating units. They are constructed of brass and are therefore rustless, and are designed to fit any tank. The heaters may be wired for control from both the kitchen and the bathroom. Covering for the tank or piping is said to be unnecessary when the proper size heater is employed.

Various sizes of these water heaters are obtainable, from 600 watts up to and including 7500 watts being offered.

Alternating-Current Elevator Controller

An alternating-current controller for elevator motors has been brought out by the Warner Elevator Manufacturing Company of Cincinnati, Ohio, and is known as type Y. It is operated from the car by means of a flexible cable. The entire operation is mechanical, resulting in the elimination of all magnets, pilot contacts, electric interlocks, etc.

The upper panel of the controller comprises the rheostat and is arranged to cut out four sections of resistance in each



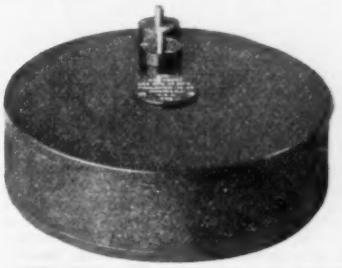
OPERATED FROM ELEVATOR CAR BY FLEXIBLE CABLE

phase of the rotor winding. This is stated to be accomplished through the force of gravity acting against the retarding action of a dash-pot, giving a positive, uniform rate of acceleration. The rotor resistance is constructed of wire spirally wound and supported on the rear of the controller by an angle-iron frame.

The lower panel carries the main-line switches which connect the stator winding direct to the line. Where the main line is opened the contacts are equipped with magnetic blow-outs to prevent all sparking and burning. Contacts are carbon to copper and all contacts are identical. Contact is made by means of separate compression springs on each arm, and the contact pressure is independent of the rapidity or force with which the shifter sheave is operated. The contacts are opened by the action of cams on the two cam shafts working against rollers on each contact arm. The panels are of electrical slate 1½ in. (3.8 cm.) thick.

Standards of Self-Inductance

Standards of self-inductance, wound on bakelite and designed to be very constant in form and unchanging with age and use, have been developed by the



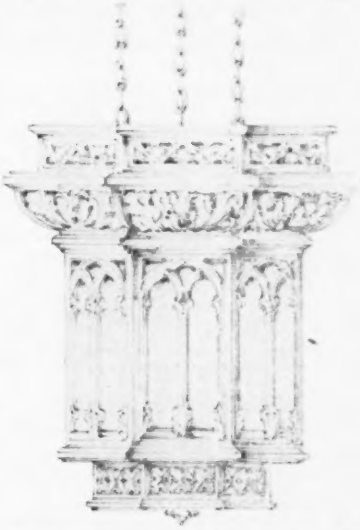
WOUND ON BAKELITE

Pyrolectric Instrument Company, 636 East State Street, Trenton, N. J. It is claimed that they have an unusually high time constant and are accurate for all frequencies up to the tone of radio frequencies. Finely divided stranded wire is used, the individual strands being insulated from each other. The standards are supplied in six styles with values ranging from 1 millihenry to 1 henry.

Church Lantern for Direct and Indirect Light

For certain classes of churches in which totally indirect illumination is unsuitable, owing to the character of the ceiling, the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has designed and placed on the market its No. 3863 Gothic lantern, which gives both direct and indirect lighting. It may be obtained either in the opaque style—that is, with solid panels—or with white cathedral glass panels in the sides and bottom.

The new lantern of the size using 100-



EITHER CATHEDRAL GLASS OR OPAQUE PANELS USED

watt or 150-watt type "C" lamps has a diameter and a depth of 22 in. (55.8 cm.), while the depth and diameter of the lantern using 300, 400 or 500-watt lamps is 36 in. (91.4 cm.).

Manufacturers' Activities

MAJOR WILLIAM J. P. SIMPSON, consulting engineer, Seattle, Wash., recently returned from France, where he has been connected with the Engineering Corps since September 1917, and will re-enter private practice, with offices at 317 Railway Exchange Building.

THE COOPER HEWITT ELECTRIC COMPANY, Hoboken, N. J., to secure more room for factory expansion, moved departments of its offices, about Dec. 1, to 95 River Street. The departments affected are the executive, auditing, sales, purchasing and patent. The engineers' department will remain at the present location in the factory, Eighth and Grand Streets.

B. J. GRIGSBY, vice-president of the Anderson Electric Specialty Company, Chicago, Ill., is visiting London and Paris in connection with the distribution of the company's products in Great Britain and France. Mr. Grigsby is particularly acquainted with those markets, having been managing director of the Benjamin Electric, Ltd., in London for nearly ten years, manufacturing electrical and automobile accessories.

R. H. RUTH has opened up a business in Rochester, N. Y., specializing in household electrical appliances. Mr. Ruth was for fifteen years with the Benjamin Electric Manufacturing Company, working in contact with the New York office but in complete charge of the Pittsburgh territory. He has spent many years in traveling around western New York State and Pennsylvania and his thorough acquaintance with the trade should stand him in good stead in his new business venture.

THE DOEHLER DIE CASTING COMPANY, with its main office and Eastern plant at Brooklyn, N. Y., and a branch plant at Toledo, Ohio, manufacturer of die castings in white metal, aluminum and brass alloys and bronze-back and aluminum-back babbitt-lined bearings, has just purchased a seven-acre tract in Chicago, on which the company will erect a modern one-story concrete steel and brick structure for the manufacture of die castings and bearings. The building is to be completed and ready for occupation and operation on or about Jan. 1, 1920.

THE MAGNAVOX COMPANY, manufacturer of anti-noise telephones and sound-amplifying apparatus, has just moved into its new factory and general offices in Oakland, Cal. During the war the entire product of the company was taken over by the government, the output being anti-noise transmitters and intercommunicating telephone sets for airplane service for the United States Army and Navy. While manufacturing for the government the factory outgrew two locations in San Francisco. The best features found in other new factories have been incorporated in the new Magnavox factory. Plenty of room for expansion and installation of new features is allowed by the five-acre tract on which the factory stands.

THE GENERAL ELECTRIC COMPANY announces that it owns a majority of the stock of the following jobbing houses, indicating its activity in the electrical jobbing field: Florida Electric Company, Jacksonville, Fla.; Mohawk Electrical Supply Company, Syracuse, N. Y.; Pacific States Electric Company, San Francisco, Cal.; Pettingell-Andrews Company, Boston, Mass.; Sibley-Pitman Electric Corporation, New York City; Southern Electric Company, Baltimore, Md.; Southwest General Electric Company, Dallas, Texas; Union Electric Company, Pittsburgh, Pa.; Wesco Supply Company, St. Louis, Mo.; Capital Electric Company, Salt Lake City, Utah (the Capital Electric Company owns a majority of the stock of Butte Electric Supply Company, Butte, Mont.); Northwestern Electric Equipment Company, St. Paul, Minn. (the Northwestern Electric Company owns a majority of the stock of Peerless Electrical Company, Minneapolis, Minn.).

THE ENERGY ELECTRIC COMPANY, Haverhill, Mass., has been established for the renewal of gas-filled and other electric lamps. Quarters have been secured at 291 River Street, and in the near future about 150 employees will be on the payroll. H. F. Nangle is president and H. P. Collins treasurer, each of these officials having been employed at the Lynn (Mass.) Works of the General Electric Company.

Supply Jobbers' Notes

THE CARROLL ELECTRIC COMPANY, Washington, D. C., jobber of electrical supplies and machinery, announces the appointment of H. L. Brittingham as purchasing agent for the company. He was formerly assistant to the sales manager.

FIFTIETH ANNIVERSARY OF WESTERN ELECTRIC COMPANY CELEBRATED BY BOSTON BRANCH. — The fiftieth anniversary of the founding of the Western Electric Company was observed at Chipman Hall, Tremont Temple, Boston, Mass., Nov. 21, by the Boston branch of the company, with an attendance of about 500 employees and guests. H. B. Gilmore, manager of the branch, delivered an informal address reviewing the history and accomplishments of the parent organization and touching upon the growth of the Boston office from small beginnings to its present quarters of 100,000 sq. ft. of floor space in South Boston. At times the staff of the Boston branch has totaled 400 persons. During the evening a number of the company's motion-picture films were displayed.

Foreign Trade Notes

BELGIAN INDUSTRIAL RECOVERY. —Recent reports on Belgian industries which have restarted show that 60 per cent of the copper foundries which were in existence in 1913 are in operation, 51 per cent of the manufacturing electrical works and 27 per cent of rolling-stock industries.

THE NATIONAL ASSOCIATION OF MANUFACTURERS, 30 Church Street, New York City, through its foreign trade department, announces the issue of the second edition of its publication "An Export Order and Allied Topics." The original issue of this publication was brought out in 1918.

THE FERRANTI ELECTRIC COMPANY, Canada, has erected a new building on the corner of Strickland and Noble Streets, Toronto. The building consists of three stories, comprising 10,000 sq. ft. of floor space, devoted to offices and the building and assembling of transformers and meters. These enlarged quarters have given the company the increased facilities necessary to take care of its expanding business. It is the company's intention next year to build an addition on this property, affording probably 20,000 sq. ft. more of floor space. Col. George C. Rice is general manager.

ITALIAN STATE MONOPOLY TAX ON LAMPS.—It was recently announced that the Italian government had decided to introduce a monopoly tax on electric incandescent lamps made in Italy or imported from other countries, and that the state would acquire the whole of the native production of lamps and undertake the sale to the trade or consumers. It is

MAKING VACUUM CLEANERS IN OHIO

The general shortage of manufactured goods is perhaps as severe in the vacuum-cleaner field as in the field of any other electrical appliance. This condition is well reflected in the illustration, which shows the interior of a part of the machine room of the Hoover Suction Sweeper Company, North Canton, Ohio. This photograph does not show the automatic bar machines of the company, of which there is a battery of six. The equipment shown consists of eight hand turrets, nine engine lathes, thirty-two drill presses, six tapping machines and eight milling machines. Starting at the left foreground and running back the entire length of the room are what are called drum fitters' benches. Sixty-five men are employed in the Hoover machine shop, which takes care of machining, drilling and filing of sweeper parts exclusive of motors. The motor-machine department is entirely separate, as is the company's tool shop. To add to this space the company is now building additional factory facilities which will occupy several thousand square feet of floor space.

not certain at this time whether the state is or is not to engage in the merchant business as was previously intimated. The decree provides for the imposition of a tax on native-made and imported lamps at the rate of 25 per cent of their value. This monopoly has been extended to Venezia Giulia.

NATIONAL TRADE CONVENTION IN 1920.—The seventh national trade convention will be held in San Francisco from May 12 to 15, 1920. One of the features will be America's first world conference of American foreign traders, while the convention will consider chiefly the effect upon American foreign trade of the fact that the United States became a creditor nation during the war and has since remained one.

BRITISH CONDUIT COMBINATION.—Regarding the combination of firms in the tube and conduit industry in England, the capital of the Tube Investment, Ltd., which is to effect the combination of the interests of Accles & Pollock, the Credenda Conduits Company, and Simplex Conduit & Tube, Ltd., is £1,250,000, equally divided into ordinary and 7 per cent cumulative preference shares. In addition Babcock & Wilcox have acquired 100,000 shares and the managing director, James Kemnal, has joined the board of the new company.

STANDARDIZATION IN SWEDEN.—As a result of the initiative taken by the Swedish Electro-Industry Association, negotiations have been begun with the object of establishing an institution for the standardization of electrical manufactures and installations. As a result of these efforts a standardizing committee has been formed having in its membership the Technological Association, the Municipal Administration, the Electricity Works Association, the Royal Water Power Board, the State Railway Board's electrical department and the Electrical Contractors' Association. It is expected that plans for undertaking all standardization work will be available by 1920.

SOUTH AFRICAN ELECTRICAL MARKET.—According to the "South African Mining and Engineering Journal" of Aug. 30, tubing has at last arrived and dealers and contractors are now in a position to prosecute to an end the jobs which have been hung up for some months past on account of the absence of this requisite article. Business on the whole is brisk both in town and country. Materials are now coming in fairly freely and there appears to be no shortage among the different electrical distributing firms. The coast, strange to say, is still short of stock and is still worrying Johannesburg for supplies. Lamps remain as last reported, namely 23 shillings per dozen, or 3 shillings each for the cheaper kinds. Notwithstanding the above, one of the largest distributing agents reports that the present month has been the worst for business experienced by him for years, as after the spirit caused by the festivities there has been practically nothing doing. Signs are, however, not wanting that next month will see a considerable increase in business. He says the mines are not buying to-day.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired by a business man in Spain (No. 31,048) for the sale of electrical machinery and material and bare copper wire. Correspondence may be in English.

A firm in Czechoslovakia (No. 31,040) desires to purchase and secure an agency for electric motors and accessories for driving printing machinery, a full description of which may be had on application to the bureau or its district offices. Illustrations, catalogs and price lists are requested. Correspondence should be in Czechic or German.

A firm in Brazil (No. 31,062) desires to secure an agency for the sale of electrical goods.

Importers in Turkey (No. 31,038) are in the market for electric motors for motion-picture machines.

A firm of manufacturers' agents in Colombia (No. 30,956), having sample rooms and several commercial travelers, desires to represent on commission and consignment basis a line of electric motors and appliances.

The English representatives of a worsted spinning firm in Poland (No. 30,939) desire to purchase motive-power machinery, boilers (Lancashire and tubular for steam raising 240 deg.), engines and turbines for a 2000-hp. plant.

A Swiss wholesale merchant (No. 30,983) of steel and metal products desires to enter into direct business relations with steel works, especially copper and brass smelting houses, and wire-drawing mills, also concerns which could supply generator sheet iron, transformer sheet iron and motor sheet iron.

A merchant in Switzerland (No. 30,959) desires to purchase all kinds of porcelain for technical purposes, such as switches, ceiling roses and wall plugs. Inquirer will order any quantity from 25,000 up to 100,000 if quality and prices are suitable. Quotations should be given f. o. b. nearest American port. Correspondence may be in English.

Trade Publications

CURRENT TAPS. — Harvey Hubbell, Inc., Bridgeport, Conn., has issued circular No. 183 on "Hubbell" current taps.

GLASSWARE. — The Macbeth-Evans Glass Company, Pittsburgh, Pa., has issued an illustrated folder on its "Alba" light, No. 5350.

MAGNETS.—The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has issued booklet "J" describing its rectangular magnets.

TURBINES.—"Steam Turbine Blading" is the title of bulletin No. 1104 recently issued by the Allis-Chalmers Manufacturing Company of Milwaukee, Wis.

FIXTURE CONNECTOR.—The H. B. Sherman Manufacturing Company, Battle Creek, Mich., describes its fixture connector in a recently issued circular.

VIOLET-RAY MACHINES.—The Bleadon-Dunn Company, Chicago, has published a fifty-two-page booklet describing its various violet ray outfits and their uses.

FIRE ALARMS.—The Inter-State Machine Products Company of Rochester, N. Y., has issued bulletin No. 500, describing its "Sterling" electric siren fire alarm, model M.

LAMP GUARD.—A mailing folder illustrating and describing the features of its "Holdfast" lamp guard is being circulated by W. N. Matthews and Brothers of St. Louis, Mo.

ALUMINUM.—The United Smelting & Aluminum Company of New Haven, Conn., has published a comprehensive 150-page book entitled "Side Lights on Aluminum and Non-Ferrous Metals."

HEATER.—Some of the uses of the Majestic electric heater are described and illustrated in a folder which has been issued by the Majestic Electrical Development Company of Philadelphia, Pa.

CIRCUIT BREAKERS. — The General Electric Company of Schenectady, N. Y., has prepared bulletin No. 47,530 to supersede bulletin No. 47,503 and to describe its type CP air circuit breakers.

LAMP COLORS AND FROSTING.—The Delco Electric Laboratories Company, 18 West Sixty-second Street, New York City, has issued a folder about its colors and frostings for lamp bulbs.

CENTRIFUGAL PUMPS.—Bulletin No. 122 from the Goulds Manufacturing Company of Seneca Falls, N. Y., contains centrifugal pumps sales service data.

SUCTION SWEEPER. — The Hamilton Beach Manufacturing Company of Racine, Wis., describes its new motor-driven suction sweeper in a recently issued circular.

PIPE TAPLETS.—The Hart & Hegeman Manufacturing Company of Hartford, Conn., is circulating a leaflet covering its pipe taplets with wide openings free from lugs.

ELECTRIC FURNACES.—Booklet 7-B of the Electric Furnace Company of Alliance, Ohio, has for its subject "Baily Electric Furnaces" for the melting of brass.

MECHANICAL APPLIANCES. — The Underwriters' Laboratories of the National Board of Fire Underwriters, 207 East Ohio Street, Chicago, has issued a booklet listing mechanical appliances.

METER CONTROL.—The Frank Adam Electric Company of St. Louis, Mo., has issued a booklet entitled "The Answer to the Tenant Meter Problem," covering meter control panels and cabinets.

TACHOMETER AND TACHOSCOPE.—Herman H. Sticht & Company, 15 Park Row, New York City, has issued a leaflet covering the "Standco" hand tachoscope and the "Standco" hand tachometer.

LUMINOUS MATERIAL.—The Radium Luminous Material Corporation, 55 Liberty Street, New York City, announces the new trademark name for its radium luminous material in a circular of recent issuance.

BUCKET ELEVATORS. — The Jeffrey Manufacturing Company of Columbus, Ohio, has published its bulletin No. 273, supplementing catalog No. 244 and covering "Jeffrey Standard" bucket elevators.

RADIANT HEATERS. — The "Universal" radiant electric heater and other electric home appliances are described by Landers, Frary & Clark of New Britain, Conn., in a recently issued folder.

GRAPHIC METERS. — The Esterline Company of Indianapolis, Ind., has published a twenty-four-page booklet entitled "Typical Graphic Records" showing records from its various graphic recording instruments.

New Incorporations

THE CARTHAGE (MISS.) LIGHT & ICE COMPANY has been incorporated with a capital stock of $30,000 by R. L. Jordan and others.

THE LYNN-CHILI ELECTRIC COMPANY of Chili, Wis., has been incorporated with a capital stock of $35,000 by H. L. Portz, Oscar G. Franke, August Lindowy and Ernest Meimas.

THE INDIANA POWER COMPANY of Vincennes, Ind., has been incorporated by C. E. Dregg, Charles E. Dove and R. N. Dreiman. The company is capitalized at $5,000,000 and proposes to supply light,

THE GURDON (ARK.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $5,000. The officers are: Thomas Neely, president and treasurer; Horace Chamberlain, vice-president, and J. C. Lewis, secretary.

THE NEWMAN ELECTRIC COMPANY of Logan, W. Va., has been incorporated with a capital stock of $10,000 by J. G. Biggs, L. Neiderlehner, Jr., of Huntington; H. C. Newman, C. S. Minter and A. G. Copley of Logan, W. Va.

THE BELL ELECTRIC ENGINEERING COMPANY, 979 Broadway, Bayonne, N. J., has been incorporated by Morris and S. Bell, both of Bayonne, and David Kline of Jersey City, N. J. The company is capitalized at $25,000 and proposes to engage in electrical construction work.

New England States

SOUTH PARIS, ME.—E. S. Lincoln of Portland, hydraulic engineer, acting, it is understood, for Massachusetts parties, has purchased the water power at Snow's Falls in the town of Paris, and the power at Biscoe Falls, 2 miles further south. These sites, it is understood, will be developed sooh to generate electricity to be distributed in West Paris and Bryant's Pond.

QUINCY, MASS.—The Gas and Electric Light Commissioners have authorized the Quincy Electric Light & Power Company to issue 1000 shares of capital stock (par value $100), with provision that the shares may be sold at $140. Part of the proceeds will be used for the erection of a substation to distribute electricity purchased from the Edison Electric Illuminating Company of Boston.

WOONSOCKET, R. I.—The Blackstone Valley Gas & Electric Company is contemplating the installation of three Westinghouse 333-kva., 13,200/550-volt transformers. Overhead-line material will be required, including 2½ miles of No. 1/0 copper and forty-five chestnut poles. P. F. Hodkins is superintendent.

DERBY, CONN. — The Southern New England Telephone Company, 114 Court Street, New Haven, contemplates the erection of a new telephone exchange building on Elizabeth Street, to cost about $50,000.

NEW BRITAIN, CONN.—The Southern New England Telephone Company, 114 Court Street, New Haven, is planning to build a new telephone exchange building on Court Street, to cost about $50,000.

NEW HAVEN, CONN.—The stockholders of the United Illuminating Company have voted to increase the capital stock of the company from $5,000,000 to $8,000,000.

OAKVILLE, CONN. — The Oakville Company is considering the erection of a new power plant, 40 ft. by 50 ft.

Middle Atlantic States

BINGHAMTON, N. Y.—The Council has adopted an ordinance providing for the construction of underground conduit systems in Chenango Street from Court to Lewis Street and in Washington Street from Court to Hawley Street. The cost is estimated at about $35,000.

CHURCHVILLE, N. Y.—The Board of Trustees has decided to call an election to submit to the voters the proposal to issue bonds not to exceed $25,000 for the installation of an electric distribution system. F. S. Tracy of Middleport is electrical engineer.

LONG ISLAND CITY, N. Y.—Plans are being prepared by Stone & Webster, engineers, 120 Broadway, New York City, for the erection of a laboratory for the Pathe Exchange, Inc., 25 West Forty-fifth Street, New York City, in Long Island City, to cost about $700,000.

NEWPORT, N. Y.—The Newport Electric Light & Power Company has applied to the Public Service Commission for authority to erect a transmission system from Middletown to Newport, a distance of 4½ miles.

NEW YORK, N. Y.—Plans are being prepared by E. I. Shire, architect and engineer, 373 Fourth Avenue, for a power house for the Baron de Hirsch School, 222 East Sixty-fourth Street, to cost about $150,000.

POUGHKEEPSIE, N. Y.—The United Hudson Electric Corporation is planning to construct a hydroelectric plant at Dashville Falls and the erection of a transmission system to supply electricity in Kingston, Saugerties, Catskill and other towns and cities where the company owns the local systems. Last August the company was granted permission by the Public Service Commission to purchase the capital stock of the Kingston (N. Y.) Gas & Electric Company, the Ulster Light, Heat & Power Company of Saugerties and the Upper Hudson Electric & Railroad Company of Catskill.

STAPLETON, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 30 for installing two electric elevators in the kitchen and mess hall at the United States Marine Hospital at Stapleton.

LAKEHURST, N. J.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to erect additional buildings and extensions in Lakehurst, including power house, railroads, landing field, water supply, sewerage system, machine shop, quarters for officers, etc. (Specification 4082). The cost of the work is estimated at about $1,126,000.

ARENDSVILLE, PA.—The local electric light plant was destroyed by fire recently, causing a loss of about $20,000. The plant was located in the flouring mill of L. E. Myers.

COATESVILLE, PA. — The Chester Valley Electric Company has nearly completed the erection of a 33,000-volt transmission line from Downington to Coatesville. Three 1500-kw. transformers have been installed at the Coatesville end of the line, stepping down the voltage to 13,200 volts for distribution to steel mills. The company is contemplating erecting a separate 13,200-volt circuit to the Midvale Steel & Ordnance Company's steel plant and to the plant of the Lukens Steel Company to give them duplicate lines. These lines will be extended either from the power house in Coatesville or from the new 33,000-volt substation near Columbia. F. W. Harris is general manager.

INTERCOURSE, PA.—The Intercourse Electric Light, Heat & Power Company is changing from three-wire, three-phase, 2300-volt line to four-wire, three-phase grounded-neutral system. All material has been purchased except 100 lightning arresters, which will be needed about April 1. Enos L. Zimmerman is general manager.

JENKINTOWN, PA.—The Philadelphia Suburban Gas & Electric Company is erecting 7 miles of electric transmission line. All material has been purchased. L R. Dutton is division manager.

LEETSDALE, PA.—Plans are under consideration by the McClintic-Marshall Company of Pittsburgh, Pa., for equipping its plant at Leetsdale for electrical operation. The company has also made arrangements for the purchase of about 100 acres of land in the vicinity of Leetsdale, to be used for expansions.

LEHIGHTON, PA. — The Lehighton Electric Light & Power Company will purchase as needed distribution transformers, 2300/220/110 volt, 60-cycle, 5-kw. to 50-kw. units; overhead-line materials, including cross-arms, braces, pins, insulators, bolts, etc.; meters, five 25-amp., 110-volt, 60-cycle, and lamps, five 15-amp., 400-cp., and 6.6-amp., 80-watt. H. F. Butler is manager.

MEDIA, PA.—The installation of new equipment in the municipal electric light plant is in contemplation, including one 200-hp. steam boiler and one 25-hp. waterwheel; also extensions and repairs to overhead lines, etc. Patrick E. Ahern is superintendent.

PHILADELPHIA, PA. — The power house of the Philadelphia & Reading Railroad Company at the Huntington Street station was recently destroyed by fire, causing a loss of about $19,000.

PHILADELPHIA, PA. — Plans have been filed by the General Carbonic Company, 838 North Third Street, for the erection of its new works, consisting of an assembly plant, power house and other buildings, to cost about $30.000. M. H. McCloskey, Jr., 1620 Thompson Street, has contract for construction of buildings.

SELLERSVILLE, PA. — The Excelsior Electric Light & Gas Company is contemplating the purchase of new transformers, twenty 5-kva., three 20-kva., five 3-kva. and five 2-kva.; 150 chestnut poles, 9 miles of No. 6 weatherproof wire; fifty 5-amp. and 10-amp. General Electric meters, and ten General Electric (Catalog No. 174,319) incandescent lamps. Charles E. Bonine, Franklin Trust Building, Philadelphia, is purchasing agent; E. W. Simkins is superintendent.

BALTIMORE, MD. — The Columbia Graphohone Company, Woolworth Building, New York, N. Y., has acquired a site at Orangeville, near Baltimore, for a new plant ,to cost about $3,600,000. The Columbia Graphohone Factories Corporation has been organized as a subsidiary to build the new works.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central States

DETROIT, MICH.—The capital stock of the Detroit Edison Company has been increased from $35,000,000 to $60,000,000.

JAMESTOWN, MICH.—The village officials have decided to install a municipal electric light plant of sufficient capacity to maintain 500 lamps, together with four or five street lamps.

MUSKEGON, MICH.—Work will soon begin by Manning, Maxwell & Moore, Inc., of New York, N. Y., on the erection of a plant to manufacture farm gas engines and machine tools, consisting of three main buildings and a foundry. The cost with equipment is estimated at about $2,000,000. Later the company plans to manufacture farm-lighting systems.

ADA, OHIO.—Improvements are contemplated by the Ada Water & Light Company, involving an expenditure of about $15,000.

ASHTABULA, OHIO. — Improvements and extensions are contemplated for the municipal electric light plant, to cost about $50,000. R. N. Case of Ashtabula is engineer.

CHICAGO, ILL.—Plans have been completed by the Continental Can Company, 111 West Washington Street, for the erection of a new plant on Ashland Avenue, near Thirty-eighth Street, to cost about $200,000.

JUNCTION, WIS.—The Ashland (Wis.) Light, Power & Street Railway Company contemplates the installation of an electric plant in Junction.

MILWAUKEE, WIS. — Bids are being taken by the Mueller & Son Company of Milwaukee, through Cahill & Douglas, consulting engineers, for a 250-kw. generator and sixty-one motors of various sizes, to be used in connection with equipping its wooden box and flooring factory at 361 Canal Street for electrical operation. F. H. Barker is president.

AUSTIN, MINN.—Plans are being prepared for the installation of an ornamental lighting system in the business district, to cost between $15,000 and $20,000. Vaughn & Meyer, Security Building, Milwaukee, Wis., are engineers.

NEW ULM, MINN.—Plans have been prepared for the construction of a new power house, 90 ft. by 90 ft., for the municipal electric light plant. The cost of the proposed improvements is estimated at $50,000.

WESTBROOK, MINN. — Bonds to the amount of $10,000 have been voted for the erection of an electric transmission line from Westbrook to Jeffers.

MANSON, IOWA.—The Manson Light, Heat & Power Company contemplates changing its system from direct to alternating current next spring. F. W. Mack is manager.

BERTRAND, MO.—The Missouri Public Utilities Company is considering extending its service from Charleston to Bertrand.

ST. LOUIS, MO.—The Emerson Electric Company, 2024 Washington Avenue, has acquired a site on which it proposes to erect a seven-story addition to its plant.

BISMARCK, N. D.—The City Council is considering the installation of an electric light plant to cost about $40.000. The equipment will include a 75-kw. generator, switchboard, a 125-hp. engine, pumps, etc. F. Tustison, Auditorium Building, Minneapolis, Minn., is engineer.

SCRANTON, N. D.—The Johnson Electric Company, recently organized with a capital stock of $200,000, is planning to erect electric transmission lines east to Lemmon, S. D., and west to Marmarth, and also to north and south. Mr. Johnson, president of the Johnson Fuel Company, is interested in the company.

MOBRIDGE, S. D.—The Mobridge Electric Company may install a new boiler and a 500-kva. or 600-kva. electric generating unit during the coming year. C. H. Bell is manager.

GENESEO, KAN.—An election will soon be called to vote on the proposal to issue bonds for the construction of an electric power plant or to erect an electric transmission line from the plant of the United Water, Gas & Electric Company at Hutchinson. The cost of the latter is estimated at about $25,000.

HAZELTON, KAN.—Plans are being prepared for the installation of a new electric lighting system including the erection of an electric transmission line. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

ST. FRANCIS, KAN.—Plans are being prepared by the Henningson Engineering Company, Twelfth and Harney Streets, Omaha, Neb., for a new municipal electric light plant. Bonds to the amount of $55,000 have been voted for the project.

Southern States

MORGANTON, N. C.—Plans are under consideration by the State Health Commission at Raleigh for the construction of a receiving building and refrigerating plant at the State Hospital for the Insane in Morganton, to cost about $100,000. J. A. Salter of Raleigh is state architect.

DUE WEST, S. C. — Bonds to the amount of $16,000 have been voted to establish a municipal electric light plant.

ST. GEORGE, S. C.—Improvements are contemplated to the municipal electric light plant within the next few months, including the installation of a new crude-oil engine and two transformers. Small minor parts for switchboard may be needed. About 1 mile of wire and 300 poles will be purchased early next year. For further information address J. Olin Horne, secretary.

SIMPSONVILLE, S. C.—The Council is considering submitting to the voters the proposal to issue $15,000 in bonds to install an electric lighting system in Simpsonville.

SUMTER, S. C.—Extensions and improvements are contemplated to the municipal electric light plant, including the installation of two 512-hp. Edge Moor boilers, two Jones underfeed stokers, coal-conveying equipment, one 1250-kva. General Electric steam turbo-generator and one eleven-panel General Electric switchboard. All equipment has been purchased. Contract for building will be let in January. W. C. Olsen is engineer in charge of the work.

WARE SHOALS, S. C. — The Ware Shoals Manufacturing Company is planning an addition to its No. 2 mill, which will require the installation of several motors. J. E. Sirrine of Greenville is engineer in charge. W. C. Cobb is superintendent.

UNADILLA, GA.—Bids, it is reported, will be received by the city of Unadilla until Dec. 31 for the construction of a municipal electric light plant. Plans and further information may be obtained from the city clerk.

HUMBOLDT, TENN. — Improvements are contemplated to the municipal electric light plant, including the installation of coal-conveying equipment (200 ft.), stokers for Stirling boiler, one 500-kw. turbine, one 500-kw. generator and switchboard equipment for same, several transformers of various sizes, several miles of overhead line equipment and about 100 meters. W. M. Case, manager, has charge of the work.

KNOXVILLE, TENN.—The Knoxville Railway & Light Company is contemplating the installation of 550-kva. alternating-current transformers and 675 type "C" lamps. C. R. Wright is engineer in charge of the work. James Link is chief engineer.

MEMPHIS, TENN.—The Sugar Products Company, 16 Exchange Place, New York, N. Y., is planning to erect a molasses storage building in Memphis, to house a 500,000-gal. tank power house, etc., to cost about $50,000.

MURFREESBORO, TENN. — The Murfreesboro Light & Power Company is planning to purchase and install as soon as possible one 300-hp. waterwheel, one 225-kw. generator with complete switchboard equipment and three 75-kw. transformers. J. C. Beasley is manager.

TRENTON, TENN.—Improvements are contemplated to the municipal electric light plant next spring, including the installation of one boiler, 72 in. by 18. ft.; one 200-hp. Unaflow steam engine and one 150-kw. generator. A. E. Cunningham is city engineer.

BIRMINGHAM, ALA. — The construction of a power house, to cost about $9,000, is under consideration by the Sloss-Sheffield Steel & Iron Company.

BIRMINGHAM, ALA. — The Birmingham Light & Power Company is planning to build a substation to supply 250-volt energy to the Edison service. The equipment will include a 1000-kw. rotary converter with switchboard. L. L. Newman is general manager.

MONTGOMERY, ALA.—Arrangements have been completed whereby the Montgomery Light & Power Company will make connection with the transmission system of the Alabama Power Company for additional power. The Montgomery company will erect a 44,000-volt transmission line from Montgomery to Vidalia and thence to Selma. The cost is estimated at about $500,000.

BOYCE, LA.—At an election to be held Dec. 30 the proposal to issue $30,000 in bonds for extensions and improvements to the municipal electric light plant and waterworks system will be submitted to the voters. Xavier A. Kramer of Magnolia, Miss., is consulting engineer.

MONROE, LA.—Bonds to the amount of $450,000 have been voted for the extensions and improvements to the municipal electric light plant and waterworks system. Walter J. Kirkpatrick is consulting engineer.

DEPEW, OKLA.—Bonds to the amount of $45,000 have been voted for extensions to the electric plant and waterworks system.

Pacific and Mountain States

ABERDEEN, WASH. — The Aberdeen Light & Power Company is installing a 512-hp. Stirling water-tube boiler, seventeen Jones stokers and coal and ash-handling equipment. All equipment has been purchased.

SQUAMISH, WASH. — The establishment of a paper and pulp mill, to cost about $1,000,000, and a hydroelectric plant, to cost $500,000, in Squamish is reported to be under consideration by Erick Hudson of Everett and associates.

TWISP, WASH.—The Twisp Light & Power Company contemplates the installation of a 100-kw. alternating-current generator and five transformers (two step-up). Materials will be required for 9 miles of overhead transmission line and forty meters. B. A. Chisholm is engineer in charge.

ASTORIA, ORE.—The Port Commission has rejected bids for installing underground electric distribution system through the port property and plans to erect a transformer house, 24 ft. by 26 ft., instead. G. Walter is electrical engineer.

GLENDALE, CAL. — Bonds to the amount of $260,000 have been voted for construction of electric generating plant and extensions to waterworks system. E. M. Lynch, Central Building, Los Angeles, is engineer.

SAN DIEGO, CAL.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has rejected bids received Nov. 26 for construction of a central building, consisting of power house at center with L-shape east and west wings, for housing utilities at the Marine Corps Base in San Diego. The cost is estimated at about $200,000.

SAN DIEGO, CAL.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the erection of a hospital at Balboa Park, to include administration building, four ward buildings, officers and nurses' quarters, laboratory, power house, laundry, garage and commander's residence, etc. The cost is estimated at about $2,000,000. B. Goodhue, 2 West Forty-seventh Street, New York, N. Y., is architect.

MACKAY, IDAHO.—The city is considering the installation of an ornamental lighting system, to cost about $20,000.

LOGAN, UTAH. — Contract has been awarded by the city of Logan for the construction of an underground distribution system (approximately 10,000 ft.) for street lighting to the Inter Mountain Electric Company of Salt Lake City. H. C. Mangham is superintendent.

ELKHORN, MONT.—Work has begun on the construction of the new mill of the Boston & Montana Milling & Mining Company, recently incorporated, in Elkhorn. The plant will be equipped with electrically operated machinery. Transmission lines will be erected to connect with the lines of the Montana Power Company. T. J. Bennett, John D. Pope of Butte, and John G. Brown of Helena are interested in the project.

Canada

PORT ARTHUR, ONT.—Work, it is reported, will start at once on the plant of the Great Lakes Pulp & Paper Company, to cost about $5,000,000. Energy to operate the proposed plant will be furnished by the hydroelectric plant at Nipigon, the contract calling for from 12,000 hp. to 16,000 hp. for delivery by Dec. 31, 1920. Hardy Ferguson, 200 Fifth Avenue, New York, N. Y., is engineer in charge of construction. Lewis L. Alsted of Appleton Wis.; George Seaman of Chicago, Ill., and James Whalen of Port Arthur are among those interested.

SHERBROOKE, QUE.—The Sherbrooke Railway & Power Company is contemplating a 5-mile extension to its street-car system. The cost is estimated at about $50,000. F. X. Conture of Sherbrooke is engineer.

Miscellaneous

VALPARAISO, CHILE. — Bids will be received at the office of the Commissioners of Ports in Santiago, Chile, until March 15, 1920, for machinery and material required for the electric and power plant for the new harbor works at Valparaiso. Plans and specifications may be obtained at the office of the Consul General of Chile, 165 Broadway, New York, N. Y.

Record of Electrical Patents

Notes on United States Patents

(Issued November 18, 1919)

14,752. PROTECTION DEVICE FOR ELECTRIC CIRCUITS; Harold De F. Arnold, East Orange, N. J. App. filed January 18, 1916. Power-limiting apparatus.

1,321,809. CIRCUIT CONTROLLER; John P. Coleman, Edgewood Borough, Pa. App. filed May 18, 1915. Notched cam shifts contacts.

1,321,880. BINDING TERMINAL; Reuben B. Benjamin, Chicago, Ill. App. filed February 29, 1916. Notched head for clamping wire.

1,321,886. RECTIFIER SYSTEM; David E. Carpenter, Wilkinsburg, Pa. App. filed February 5, 1914. Short circuits within rectifiers avoided.

1,321,934. ELECTRIC LAMP: Gerald E. Merchant, Rochester, N. Y. App. filed September 7, 1916. Socket holds lamp by spring clips.

1,321,949. FUSE; Leon Teale, New York, N. Y. App. filed June 12, 1919. Renewable type.

1,321,989. THERMIC TELEPHONE AND ITS MANUFACTURE; Pieter de Lange and Robert Aernout, Baron van Lynden, Utrecht, Netherlands. App. filed November 4, 1915. Building up looped conductors.

1,321,990. HEATING CONDUCTOR FOR THERMIC TELEPHONES; Pieter de Lange and Robert Aernout, Baron van Lynden, Utrecht, Netherlands. App. filed November 4, 1915. Greatest sound-producing length within small space.

1,321,998. SUBMARINE-BOAT-DETECTION APPARATUS; Giovanni E. Ellia, Fort Monroe, Va. App. filed July 13, 1918. Reduced fluid pressure recorded at receiving station.

1,322,000. ELECTROLYTIC HIGHER-OXIDE-OF-MANGANESE DEPOLARIZING AGENT AND PROCESS OF MAKING SAME; Carleton Ellis, Montclair, N. J. App. filed December 6, 1916. Soluble manganous salt exposed to electrolytic oxygen.

1,322,001. DENSIFIED DEPOLARIZING AGENT AND PROCESS OF MAKING SAME; Carleton Ellis, Montclair, N. J. App. filed December 6, 1916. Use of manganese dioxide.

1,322,010. TELEGRAPH SYSTEM: Olof D. M. Guthe, New York, N. Y. App. filed Jan. 2, 1918. Printing telegraphy as in Baudot code.

1,322,025. AUTOMATIC TELEPHONE SYSTEM; Alexander E. Keith, Hinsdale, Ill. App. filed August 31, 1914. Amount of apparatus necessary greatly reduced.

1,322,065. LOCKING SWITCH; Edson O. Sessions, Chicago, Ill. App. filed November 2, 1917. For heavy alternating current circuits.

1,322,073. METHOD OF FORMING HEATER ELEMENTS FOR LIQUID HEATERS; Frank J. Stuart, St. Louis, Mo. App. filed August 22, 1917. Coil in closed receptacle.

1,322,075. SEPARABLE PLUG; Clarence A. Vetter, Pittsburgh, Pa. App. filed January 7, 1916. Secure locking arrangement.

1,322,079. FUSE PLUG; Angelo J. Zarlinga and Edward J. Korbel, Chicago, Ill. App. filed May 27, 1918. Renewable fuse plug with indication of blown fuse.

1,322,097. RELAY; Charles W. Dunham, Edgewood Borough, Pa. App. filed Nov. 25, 1916. Reluctance of circuit varied.

1,322,102. STORAGE BATTERY; William Gardiner, Chicago, Ill. App. filed September 29, 1916. Prevents plates from buckling.

1,322,226. ADJUSTABLE ELECTRICAL CONNECTION; William G. G. Bulloch, Washington, D. C. App. filed March 6, 1919. For vacuum cleaner.

1,322,254. RELAY FOR TELEGRAPH AND OTHER ELECTRIC CIRCUITS; Donald McNicol, New York, N. Y. App. filed May 2, 1918. For either alternating current or direct current.

1,322,264. INDUCTION MOTOR; Robert H. Pool and Grover A. Hughes, Youngstown, Ohio. App. filed July 10, 1917. Regulates primary current and torque.

1,322,265. SWITCH; Henry D. Rahling, Niagara Falls, N. Y. App. filed May 20, 1916. Protects main contacts.

1,322,319. APPARATUS FOR REPRODUCING ROTARY MOTION; Brunson McCutchen and Harold E. Williams, Washington, D. C. App. filed November 2, 1918. By electrical impulses.

1,322,405. METHOD AND APPARATUS FOR TESTING MAGNETIZARLE OBJECTS BY MAGNETIC LEAKAGE; Charles W. Burrows, Washington, D. C. App. filed October 4, 1917. Change in induction measured by test coils.

1,322,451. ALTERNATING-CURRENT MOTOR; Harry W. Jeannin, Warren, Ohio. App. filed January 17, 1917. Repulsion type.

1,322,471. DYNAMO - ELECTRIC MACHINERY; Leigh J. Stephenson, Chicago, Ill. App. filed May 15, 1919. Suitable for electric railways.

1,322,503. RELAY FOR UNDULATORY CURRENTS; Eugene Reisz, Berlin, Germany. App. filed June 18, 1914. Exhausted discharge tube comprises cathode.

1,322,504. DUPLEX CONNECTION FOR TELEPHONE RELAYS; Eugene Reisz, Treptow, near Berlin, Germany. App. filed July 31, 1915. Separate trunk sections in vicinity of relay.

1,322,506. PNEUMATO-ELECTRIC CIRCUIT CLOSER; John T. Austin, Hartford, Conn. App. filed July 28, 1916. Spring fingers constitute contacts.

1,322,545. MULTIPLE SWITCH; Herbert W. Crane, Chicago, Ill. App. filed August 16, 1917. Operates in timed relation to a motor-driven device.

1,322,556. ELECTRICALLY HEATED BOILER; George Fleming, Princeton, Tex. App. filed January 29, 1919. Minimum space occupied.

1,322,573. ELECTRICAL RESISTANCE MATERIAL AND PROCESS OF MAKING; Otis Hutchins and Alfred W. Oliver, Niagara Falls, N. Y. App. filed March 25, 1919. Silicon carbide and clay.

(Issued November 25, 1919)

1,322,670. ELECTRIC HEATING ATTACHMENT FOR COOK STOVES AND RANGES; Joseph A. Dagenais, Hull, Quebec, Can. App. filed May 10, 1919. Confines heat.

1,322,701. ELECTRICAL HEATING UNIT; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed January 25, 1917. Looped frame holds resistor.

1,322,749. PHASE-DISTRIBUTION SYSTEM; Thaddeus F. Baily and Frank T. Cope, Alliance, Ohio. App. filed June 27, 1918. Employs all phases in electric furnaces of resistance type.

1,322,848. ELECTRIC RIVETING; Edmund J. von Henke, New York, N. Y. App. filed October 28, 1918. For heavy plates and sheets.

1,322,860. ELECTRIC WATER HEATER; Benjamin F. Wubbens, William F. Hupp and Henry F. Hegeman, Cedar Rapids, Iowa. App. filed May 7, 1917. Automatic temperature controller.

1,322,870. POLARITY - REVERSING SWITCH; Stephen F. Briggs, Milwaukee, Wis. App. filed February 27, 1915. Prevents pitting of contact points.

1,322,995. MOTOR CONTROLLER; Thomas E. Barnum, Milwaukee, Wis. App. filed April 3, 1916. Establishes starting and running positions for alternating-current motors and cuts off to initial position.

1,323,045. TOY ELECTRIC MOTOR; Alfred C. Gilbert, New Haven, Conn. App. filed April 18, 1916. With pole-changing switch for reversing.

1,323,047. ELECTRIC RANGE SWITCH; Gilbert W. Goodridge, Bridgeport, Conn. App. filed October 5, 1917. Fuses and switch on same base.

1,323,084. ELECTRIC HEATING ELEMENT; Frederick W. Moffat, Weston, Ont., Can. App. filed April 12, 1918. Disk-type heater with spirally arranged element.

1,323,094. CIRCUIT CLOSER; Eber F. Piers, Ogden, Utah. App. filed March 21, 1919. For railway brake systems.

1,323,113. CIRCUIT CLOSER FOR TANK INDICATORS; Maximilian C. Sprangers, Rochester, N. Y. Signal operated by change of fuel levels in tank.

1,323,155. ADJUSTMENT OF WAVE LENGTHS; George H. Clark, Washington, D. C. App. filed January 18, 1915. Settings made for different wave lengths or frequencies.

1,323,176. ROTARY RHEOSTAT; Robert T. Ebeling, Oakland, Cal. App. filed September 18, 1917. Dimming incandescent light used in electric signs, spotlights, etc.

1,323,178. INCANDESCENT WELDING WITH ELECTRICITY; Francis G. Gale, Waterville, Que., Can. App. filed March 29, 1916. Articles of different cross-sectional area welded without preheating.

1,323,191. ELECTRIC INSULATION; Claud H. Klyne, Sheerness, England. App. filed May 12, 1917. Laminated mica.

1,323,203. THERMOSTAT; Even J. Rohne, Minneapolis, Minn. App. filed February 28, 1918. Simplified adjustment.

1,323,220. FILAMENT TYPE OF HEATING ELEMENT; Charles J. Heiser, Los Angeles, Cal. App. filed June 20, 1918. Inclosed in cylindrical case.

(Issued December 2, 1919)

1,323,236. METHOD OF INSULATING ALUMINUM COVERED COPPER CONDUCTORS; Harry M. Abernethy and Harry D. Abernethy, Cleveland, Ohio. App. filed April 17, 1916. Electrolyte, porous cup and mercury.

1,323,238. CIRCUIT - INTERRUPTING DEVICE; Chester T. Allcutt, Wilkinsburg, Pa. App. field Sept. 1, 1917. Trip coil,, series transformer and spark gap.

1,323,247. VAPOR-CONVERTER SYSTEM; Lewis W. Chubb, Edgewood Park, Pa. App. filed Dec. 2, 1915. For smoke precipitation and X-ray work.

1,323,248. CONTROL SYSTEM; John A. Clarke, Jr., Edgewood Park, Pa. App. filed Aug. 9, 1916. Series parallel to parallel operation for railway motors.

1,323,271. PHASE-CONVERTING SYSTEM WITH INHERENT BALANCING MEANS; Rudolf E. Hellmund, Swissvale, Pa. App. filed Aug. 11, 1917. Maintains balance in phases.

1,323,272. SYSTEM OF CONTROL; Rudolf E. Hellmund and Ralph E. Ferris, Swissvale, Pa. App. filed May 4, 1915. Prevents undesirable current surges.

1,323,275. SWITCH; Oliver P. Hipple, Wilkinsburg, Pa. App. filed Sept. 30, 1916. Compensates for wear.

1,323,288. EXCITING SYSTEM FOR BOOSTER INTERPOLE ROTARY CONVERTERS; Gustaf A. Juhlin, Sale, Eng. App. filed Oct. 21, 1916. Sparkless commutation obtained.

1,323,289. CONTROL APPARATUS; Herbert G. Jungk, Pittsburgh, Pa. App. filed Oct. 13, 1917. Regulation of induction motors with water rheostat.

1,323,300. CIRCUIT INTERRUPTER; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed Jan. 4, 1916. Utilizes self-aligning and the initial tensioning devices.

1,323,304. ELECTRICAL ARCING DEVICE FOR LIGHTING AND INTERRUPTION; Louis Mauclaire, Paris, France. App. filed April 22, 1916. Rotary arc of constant length.

1,323,307. STORAGE BATTERY; Irvine M. Noble and Walter E. Gossling, Indianapolis, Ind. App. filed Aug. 26, 1918. Secures terminal parts of electrodes in cover.

1,323,327. CIRCUIT INTERRUPTER; Joseph Slepian, Wilkinsburg, Pa. App. filed Dec. 31, 1918. Electrolyte absorbs energy when circuit is interrupted.

1,323,330. ELECTRICAL CONTROL MECHANISM; Alfred L. Sohm, Chicago, Ill. App. filed May 21, 1917. Impulses transmitted to secondary clock circuit.